

Trouble-shooting instructions: AUD-5011

BOSCH system : EI-K

Vehicle make : Audi

Basic microcard : PKW-051

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SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Audi model:
Audi 90, 2.3 E, California
Engine 2,3 l, 5 cyl. 100 kW Code letter NG
Year of manufacture 1987

- *EI-K control unit 0 227 400 136
- *Ignition coil with trigger box 0 221 600 050
- *Ignition coil with no trigger box 0 221 122 358
- *Version code
- *Activate self-diagnosis as follows:

The KE-Jetronic control unit is equipped with a permanent memory. Faults in the EI-K control unit are also stored in this memory. Fault output is separated again according to EI-K and KE Jetronic.

Test prerequisites:

Fuses 13, 19, 24, 28 O.K. Air conditioner off.
Intake-manifold ground connection O.K.

The following test sequence must be maintained:
Activate EI-K

(With fault memory cleared, perform test run for at least 5 minutes on road/roller dynamometer at engine speed in excess of 3000 min⁻¹. In doing so, briefly depress accelerator pedal to the full. Or if engine not running, actuate starter for approx. 6 seconds).

Ignition OFF. Ignition ON. Bridge contacts at electric fuel pump relay with fuse for at least 4 seconds. Note down flashing code. Continue bridging contacts until flashing code 0 0 0 0 (end of fault output) appears.
Refer to basic instructions for evaluation of flashing code.

SPECIAL FEATURES (Continued)

Activate KE-Jetronic

This can only be done following EI-K fault output "end".
Bridge contacts for at least 4 seconds.
Note down flashing code (SIS KE-Jetronic).
Continue bridging contacts until flashing code 0 0 0 0 (end of fault output) appears.

Activate final-controlling-element diagnosis

Ignition OFF. Bridge contacts. Ignition ON.
Bridge contacts for at least 4 seconds.
Flashing code indicates which final controlling element is actuated (SIS KE-Jetronic).
Continue bridging contacts until flashing code 0 0 0 0 (end off fault output) appears.
Do not switch off ignition.

Reset fault memory

The fault memory can only be reset following final-controlling-element diagnosis.
Bridge contacts for at least 4 seconds.
The fault memory is r e s e t .
The fault lamp is OFF.
Eliminate fault. Then carry out test run.
Re-activate self-diagnosis (to see whether all faults have been eliminated).

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Keep people away from danger.
Prevent damage to the engine, trigger box and control unit, or ignition system.

* C A U T I O N !

High-performance ignition system.
Dangerous high and low voltages.

Do not touch voltage-carrying parts or terminals; risk of fatal injury on primary and secondary sides.

*Before carrying out compression testing, remove the control-unit plug or connect ignition coil term. 4 f i r m l y to ground with auxiliary cable.

N o t e : The auxiliary cable must be interference-suppressed to min. 2 k Ω .

For further precautionary measures see the basic instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty
2. Engine starts but then dies
3. Idle problems (engine speed, exhaust)
4. Poor throttle response.
5. Engine missing (ignition, injection)
6. Insufficient maximum power/speed
7. Excessive fuel consumption
8. Engine diesels
9. Engine pings/knocks
10. Engine overheats
11. Fault lamp.

Cause (component fault)										
*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*			*							High-voltage side
*			*							Ignition coil
*										Firing sequence
*										Voltage - EI-K control unit
*										Ignition-distributor plug and socket
*										Voltage, magnetic pulse generator
*										Function, magnetic pulse generator
*										EI-K control units, function
*										Voltage, trigger box
*										Primary signal
*										Triggering, electric fuel pump relay

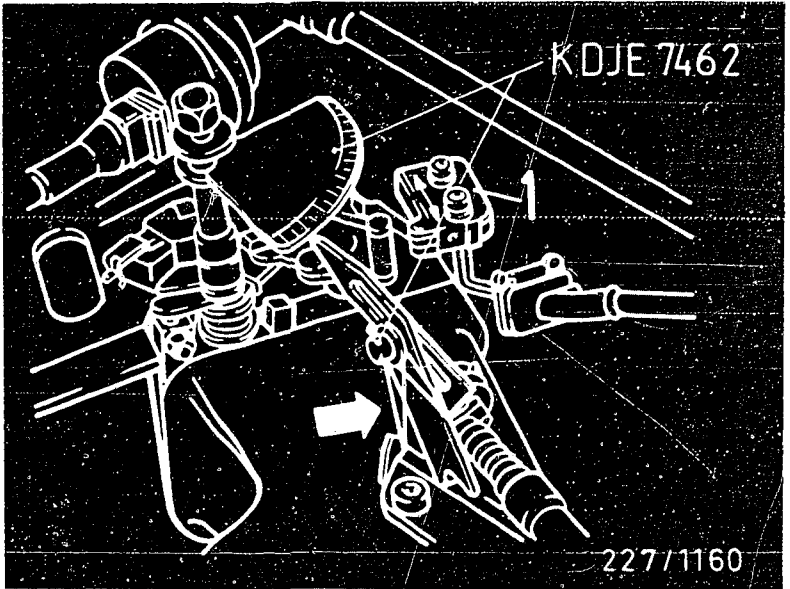
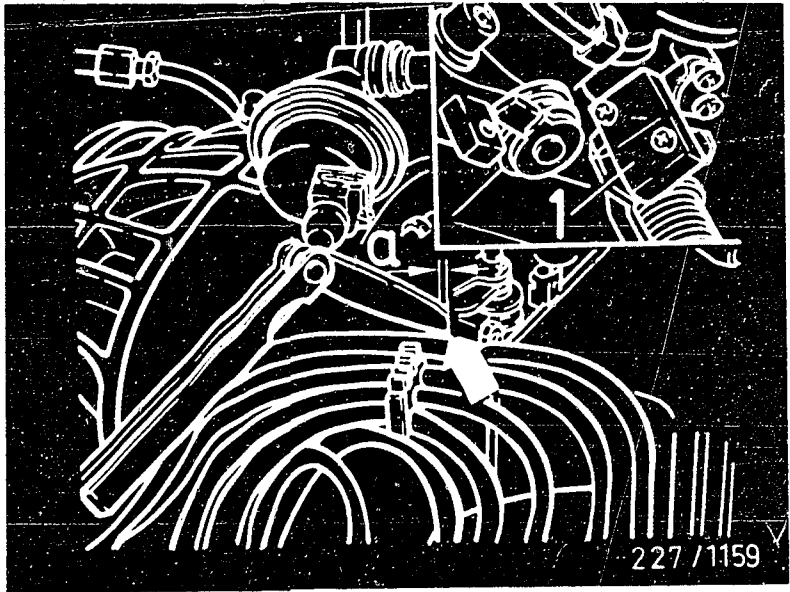
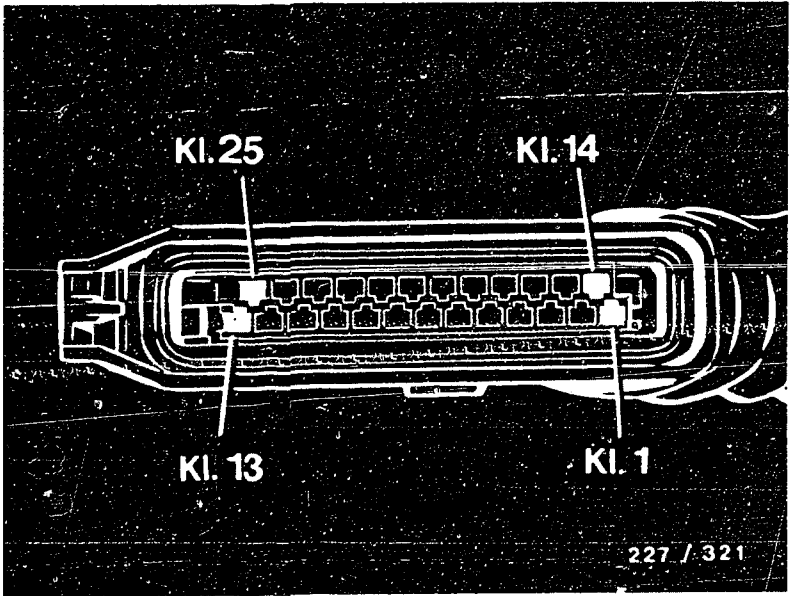
TROUBLE-SHOOTING CHART (continued)
Customer complaint (symptoms of trouble)

1. Starting motor operates, engine fails to start or starts with difficulty.
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Cause (component fault)										
*										Contact resistance
*										Ignition distributor installation setting
									*	Fault lamp
*				*	*		*	*	*	Basic ignition setting
			*							Voltage, EI-K control unit
			*							Voltage, ignition coil

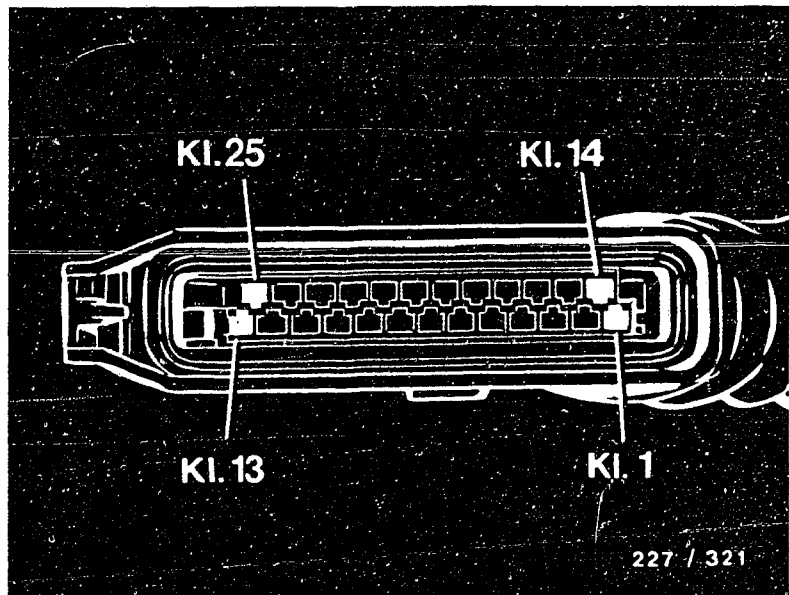
SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function Test instructions/conditions	Termi- nals	Set values
1 1 1 1	EI-K CONTROL UNIT Replace EI-K control unit.	—	—
2 1 2 1	THROTTLE-VALVE SWITCH - IDLE Voltage, EI-K control-unit plug. Upper illustration. Check cut-in point: Ignition ON. Throttle-valve open. Slowly close throttle valve. Insert feeler gauge between throttle- valve stop and adjusting screw. Cut-in point 0,15...0,5 mm for idle stop. See center illustration, arrow (a = 0,15...0,5 mm, 1 = switch).	7 20 (+) (-)	0 V Approx. battery voltage
2 1 2 3	THROTTLE-VALVE SWITCH - FULL LOAD Voltage, EI-K control-unit plug. Throttle valve in idle position. Ignition ON. Secure pointer of protractor to throttle support bracket with rubber band. Screw graduated disc on to throttle valve stage 1. Push throttle-valve lever to full-load stop and set graduated disc to 0°. Cut-in point 6°...14° before full- load stop.	9 20 (+) (-)	0 V Approx. battery voltage

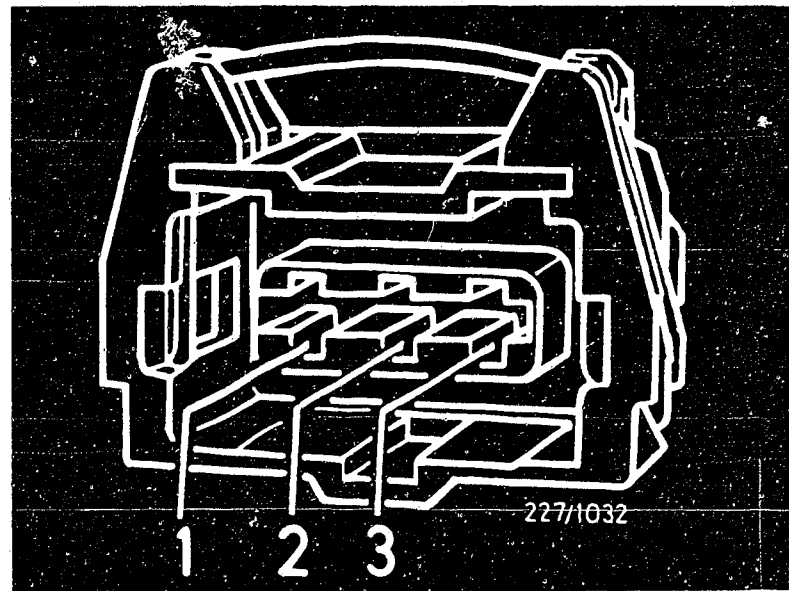


SELF-DIAGNOSIS TEST TABLE (continued)

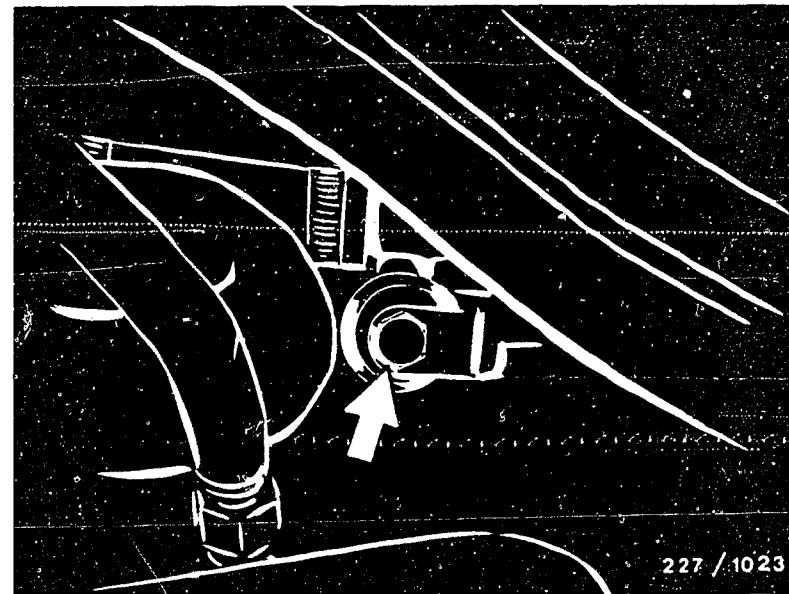
Fault indication Flashing code	Testing of component/function Test instructions/conditions	Terminals	Set values
2 1 3 2	SELF-DIAGNOSIS (data transfer) EI-K/ KE-Jetronic control unit defective. Or open-circuit in lead between EI-K/ KE-Jetronic control-unit plug.	5 1 3 13	approx. 0 Ω approx. 0 Ω
2 1 4 1	MAXIMUM RETARDATION OF KNOCK CONTROL Check fuel with too low an octane number, ignition-timing adjustment, fuel- injection system. Bearing damage, abnormal engine noise.	—	—
2 1 4 2	KNOCK SENSOR Resistance, EI-K control-unit plug (top picture) and knock-sensor plug connection (center picture). Resistance, knock-sensor plug connection. See center picture. Tightening torque. See bottom picture, arrow.	13 1 12 2 12 3 1 2	Approx. 0 Ω Approx. 0 Ω Approx. 0 Ω Infinity Ω 15-25 Nm
2 2 2 3	ALTITUDE SENSOR Voltage, EI-K control-unit plug. See top picture. Ignition ON.	2 20 (+) (-)	Sea level = 3,2...4,7V 500 m = 2,8...4,0V 1000m = 2,4...3,5V 1500m = 2,0...3,0V 2000m = 1,5...2,5V 3000m = 0,8...1,6V



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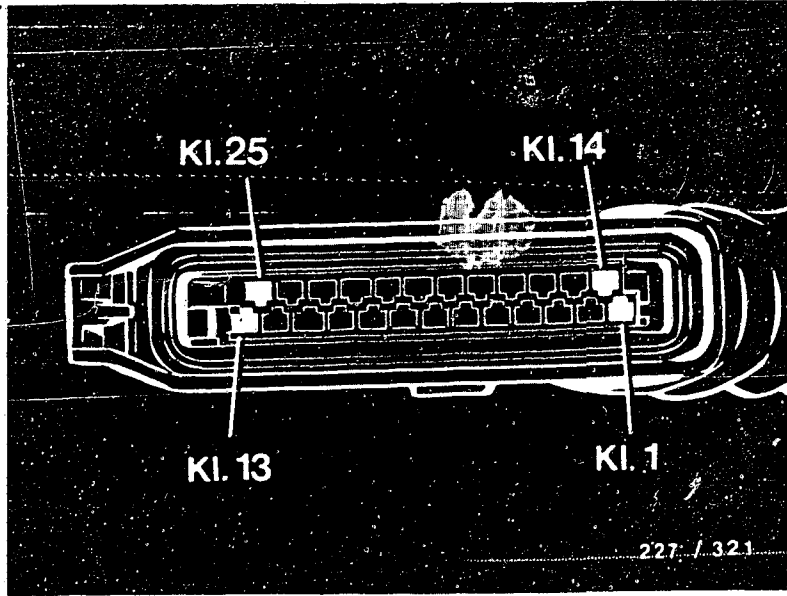
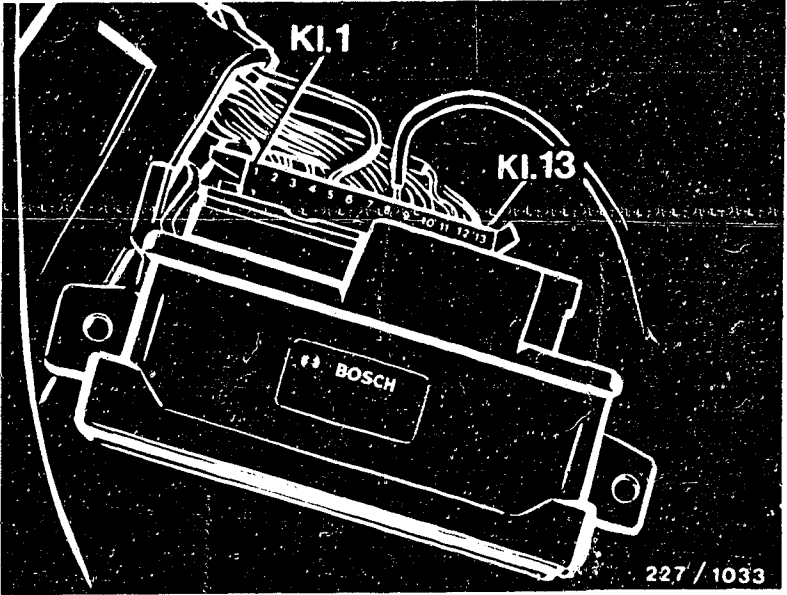
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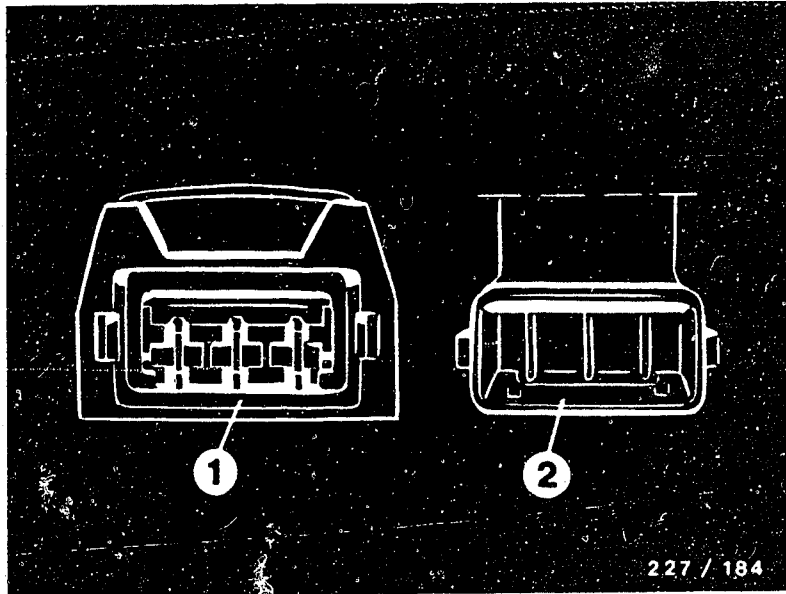
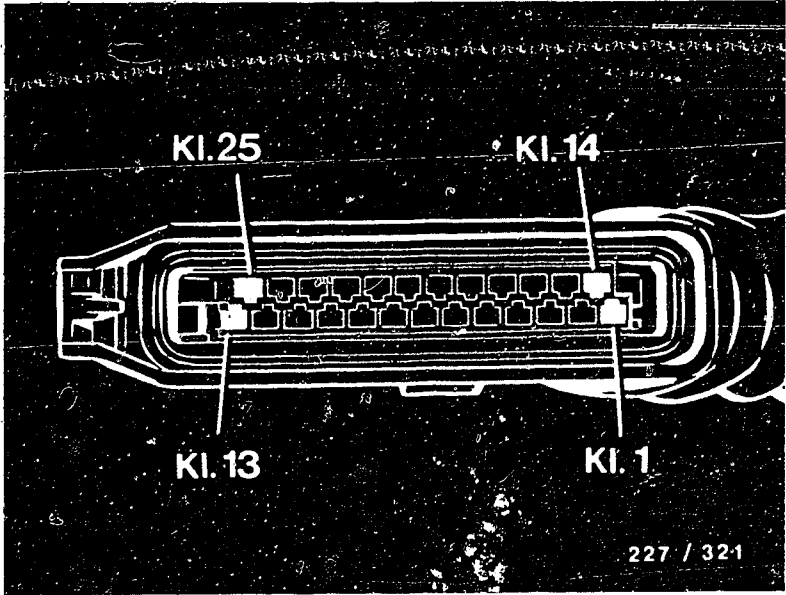
SELF-DIAGNOSIS TEST TABLE (Continued)

Fault display Flash code	Testing of component/function Test instructions/conditions	Term.	Set values
2 2 3 2	LOAD SIGNAL Voltage, EI-K control-unit plug with handle cover removed. See upper illustration. Engine at idle.	8 20 (+) (-)	0,2...4,6 V
2 2 3 3	REFERENCE VOLTAGE FOR LOAD- AND ALTITUDE-SENSOR SIGNAL Voltage, EI-K control-unit plug. See lower illustration. Ignition ON.	21 20 (+) (-)	4,5...5,1 V
2 3 1 2	TEMPERATURE SENSOR - COOLANT Resistance of EI-K control-unit plug. See lower illustration.	25 20	+ 20°C=2,1...2,9k Ω + 30°C=1,4...2,0k Ω + 80°C=280...370 Ω + 90°C=210...280 Ω +100°C=160...210 Ω
4 4 4 4	NO FAULT IN MEMORY	—	—
0 0 0 0	END OF FAULT OUTPUT	—	—



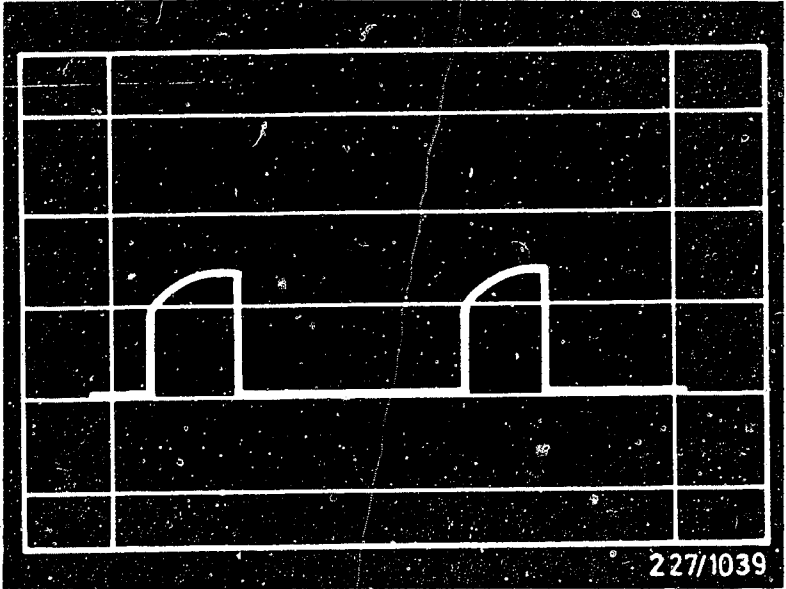
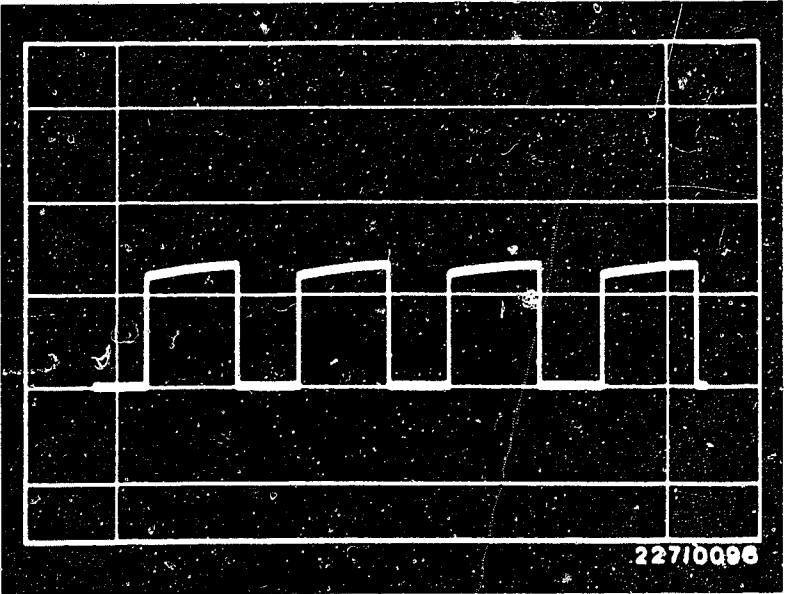
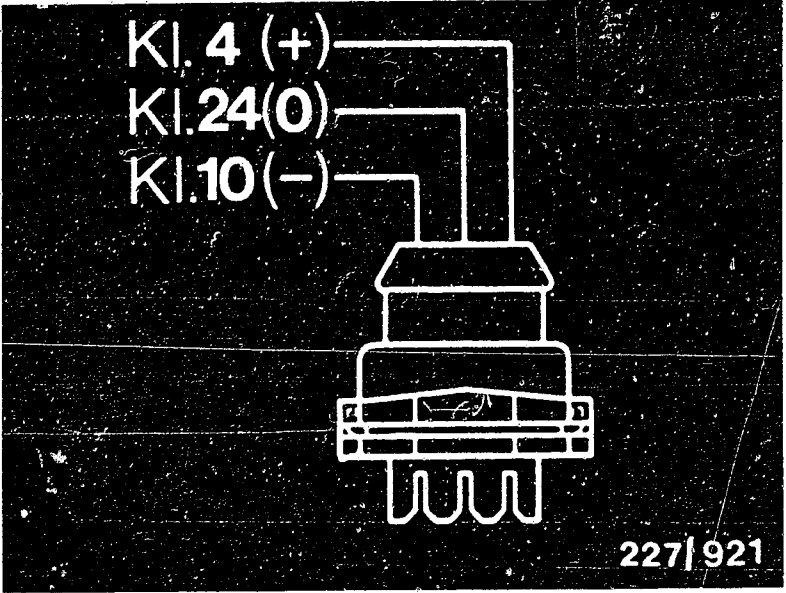
RAPID DIAGNOSIS CHART

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
1	HIGH-VOLTAGE SIDE Test for example spark plugs, ignition harness, distributor cap etc. for proper functioning (e.g. open circuit, shunt). Assessment for example by ignition oscillogram, resistance measurement, visual examination.	—	—
2	IGNITION COIL Visual examination (Bosch only): plug fitted, sealing compound escaped? Resistance, primary (Bosch) Resistance, primary (non-Bosch) Resistance, secondary (Bosch) Resistance, secondary (non-Bosch)	— 1 15 1 15 1 4 1 4	— 0,6... 1,0 Ω 0,5... 1,5 Ω 6,4...11,1 k Ω 5,0... 9,0 k Ω
3	VOLTAGE SUPPLY, EI-K CONTROL UNIT Disconnect EI-K control-unit plug. Ignition ON. Voltage, EI-K control-unit plug. See upper illustration. * If term. 22 present	 6 20 (+) (-) 6 *22 (+) (-)	 Battery voltage Battery voltage
4	IGNITION-DISTRIBUTOR PLUG AND SOCKET Disconnect ignition-distributor plug. Visual examination: check ignition-distributor plug and socket for oxidation. See lower illustration.	—	—



RAPID DIAGNOSIS CHART (continued)

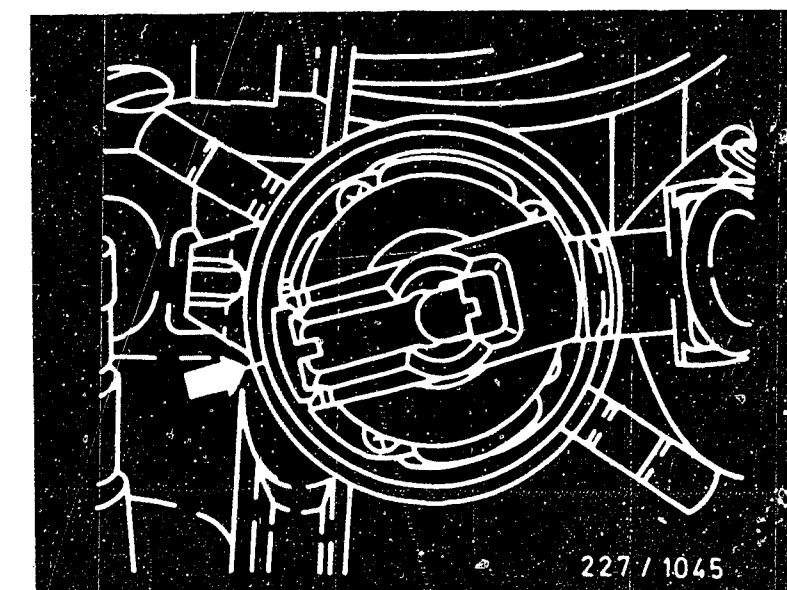
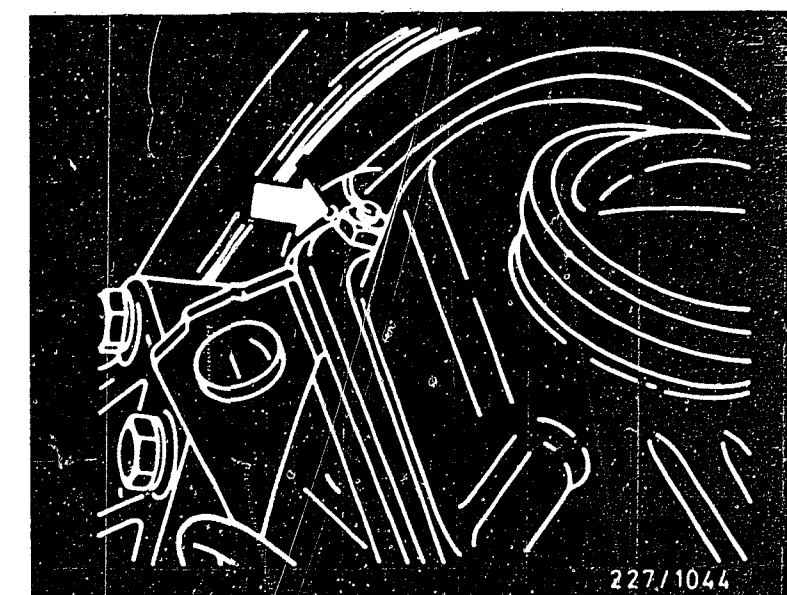
Test step	Testing of component/function Test instructions/conditions	Term.	Set values
5	VOLTAGE SUPPLY, MAGNETIC PULSE GENERATOR Connect ignition distributor and EI-K control-unit plugs. Ignition ON. Voltage, ignition-distributor plug. See upper illustration.	4 10 (+) (-)	equals/above 10 V
6	MAGNETIC PULSE GENERATOR - FUNCTION Start engine. "Special" oscilloscope to ig.-distributor plug. See upper illustration.	24 B- (+) (-)	Rectang. pulse (centre illus.)
7	EI-K CONTROL-UNIT - FUNCTION Trigger-box, ignition-distributor, and EI-K control-unit plugs connected. Start engine. "Special" oscilloscope to trigger-box plug.	2 B- (+) (-)	Rectang. pulse (lower illus.)
8	VOLTAGE SUPPLY, TRIGGER BOX Disconnect trigger-box plug. Ignition ON. Voltage, trigger-box plug.	1 3 (+) (-)	Battery voltage



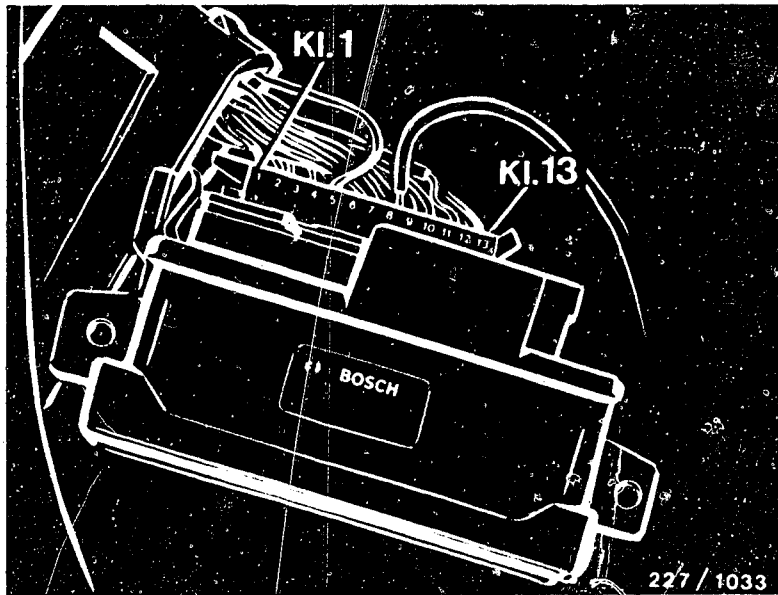
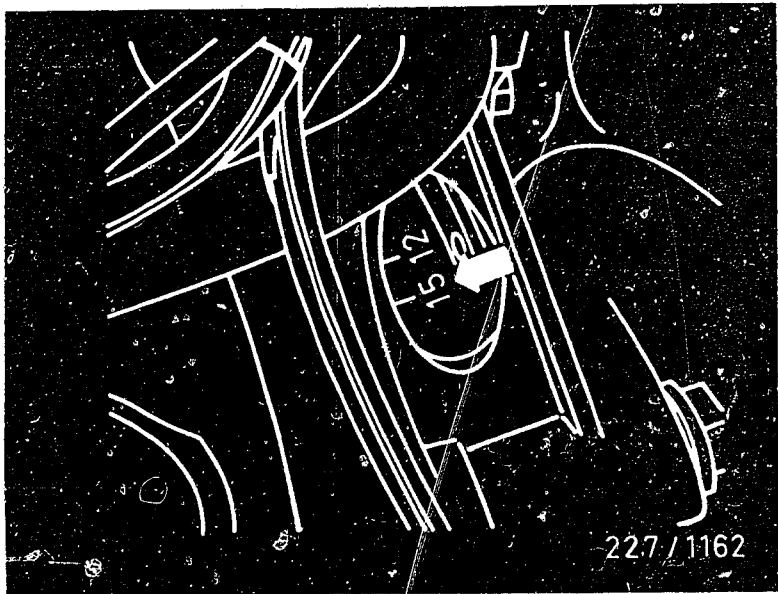
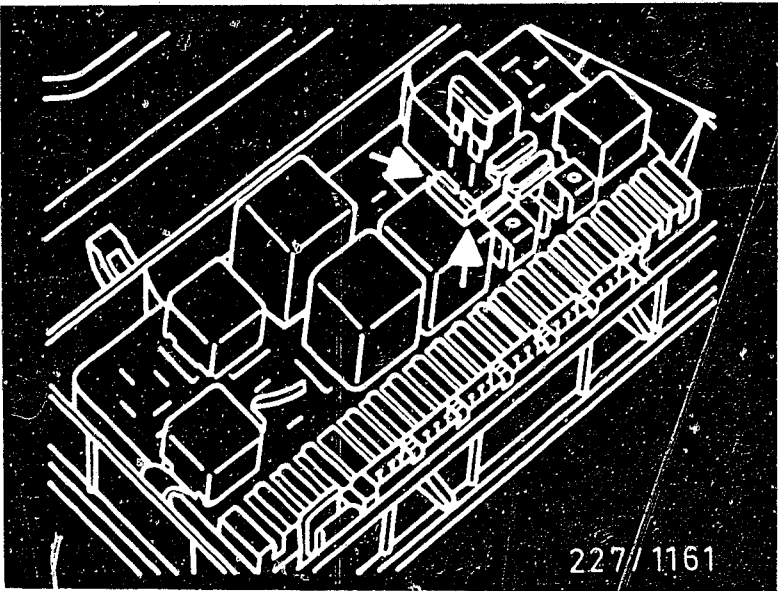
RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test instructions/conditions	Term.	Set values
9	PRIMARY SIGNAL EI-K control-unit, trigger-box, and ignition-distributor plugs connected. Start engine. Oscilloscope/engine-speed tester to igr. coil.	15 1 (+) (-)	Primary voltage - engine-speed display (level unimportant)
10	TRIGGERING, ELECTRIC FUEL PUMP RELAY Ignition ON. The electric fuel pump relay including the electric fuel pump are triggered (can be heard).	—	Triggering approx. 1 second
11*	CONTACT RESISTANCES Check trigger-box voltage supply leads or primary circuit for contact resistance.	various	max.0,5 Ω
12*	IGNITION-DISTRIBUTOR INSTALLATION SETTING Engine cyl. 1 at TDC. Upper illustration. Camshaft marking aligns with upper edge of valve-cover seal. Center illustration. Middle of distributor rotor points to housing marking. Lower illustration.	—	—
13	FAULT LAMP Ignition ON. Engine at idle.	— —	Fault lamp lights up Fault lamp OFF

* carry out only when engine not running.



Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
14	BASIC IGNITION SETTING Engine-oil temperature at least 80° °C Throttle-valve idle position. Air conditioner switched off. Fault lamp must not flash. Bridge contact at electric-fuel-pump relay with fuse. See upper illustration, arrow. Engine at idle. Note: Setting $15 \pm 1^\circ$ before TDC. See center illustration, arrow.	—	13...17° before TDC
15	VOLTAGE SUPPLY, EI-K CONTROL UNIT Voltage, EI-K control-unit plug with handle cover removed. See lower illustration. Engine at idle.	6 20 (+) (-)	12 - 14 V Max. 2 V below battery +ve
16	VOLTAGE SUPPLY, IGNITION COIL Engine at idle. Voltage, ignition coil and battery.	15 B- (+) (-)	Equal to/greater than 10 V



TEST SPECIFICATIONS

Idle throttle-valve switch with ignition ON	
Open throttle valve	0 V
Feeler gauge between throttle-valve stop	0,15...0,50 mm Approx. battery voltage
Full-load throttle-valve switch with ignition ON in idle position	0 V
Throttle valve	6°...14° before full-throttle stop Approx. battery voltage
Knock sensor Tightening torque	15...25 Nm
Altitude sensor Sea level	3,2...4,7 V
500 m	2,8...4,0 V
1000 m	2,4...3,5 V
1500 m	2,0...3,0 V
2000 m	1,5...2,5 V
3000 m	0,8...1,6 V
Load signal with engine at idle	0,2...4,6 V

TEST SPECIFICATIONS (Continued)

Reference voltage for load and altitude sensors with ignition ON	4,5... 5,1 V
Temperature sensor - coolant	+20°C 2,1... 2,9k Ω +30°C 1,4... 2,0k Ω +80°C 280... 370 Ω +90°C 210... 280 Ω +100°C 160... 210 Ω
Ignition coil primary (Bosch)	0,6... 1,0 Ω
primary (non-Bosch)	0,5... 1,5 Ω
secondary (Bosch)	6,4...11,1 k Ω
secondary (non-Bosch)	5,0... 9,0 k Ω
Voltage supply, EI-K control unit with ignition ON	Battery voltage
Voltage supply, magnet pulse generator with ignition ON	Equals/above 10 V
Magnet pulse generator functioning at cranking speed	Rectangular pulse

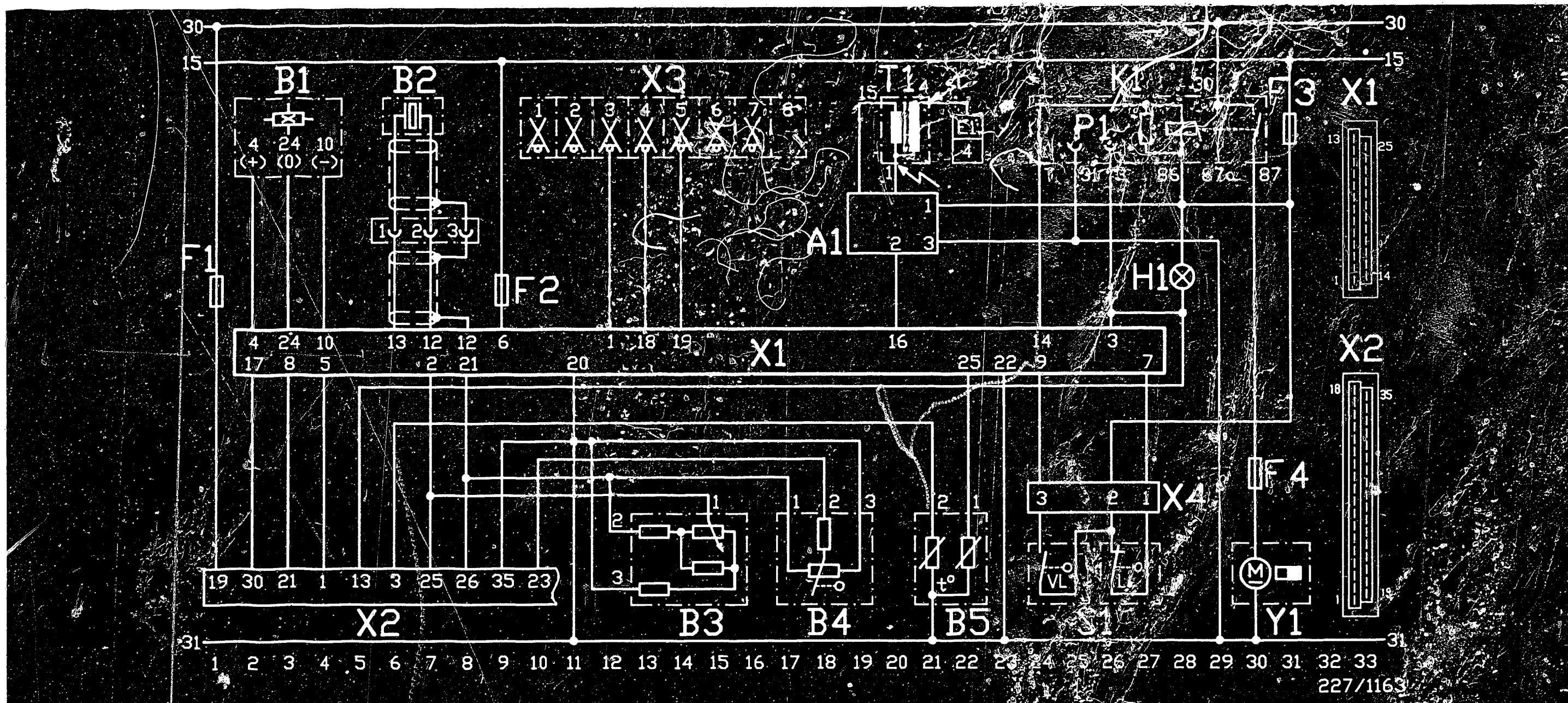
TEST SPECIFICATIONS (continued)

EI-K control unit functioning at cranking speed	Rectangular pulse
Voltage supply, trigger box with ignition ON	Battery voltage
Primary signal at cranking speed	Primary voltage/ engine-speed display
Triggering of electric fuel pump relay with ignition ON	Approx. 1 second (acoustic)
Contact resistance	max. 0,5 Ω
Supply leads, trigger box or primary circuit	
Ignition-distributor installation setting	Cyl. 1 at TDC Igtn.-dist. marking
Fault lamp Ignition ON with engine idling	ON OFF

TEST SPECIFICATIONS (continued)

Basic ignition setting	
Electrical fuel pump relay bridged	
Engine idling	13...17° before TDC (Setting value 15 \pm 1°)
Voltage supply, EI-K control unit Engine idling	12 - 14 V max. 2 V below battery voltage
Voltage supply, ignition coil Engine idling	equals/above 10 V

For setting values for idle speed, exhaust,
valve play, etc. see the Jetronic SIS
microcard or Autodata test specifications.



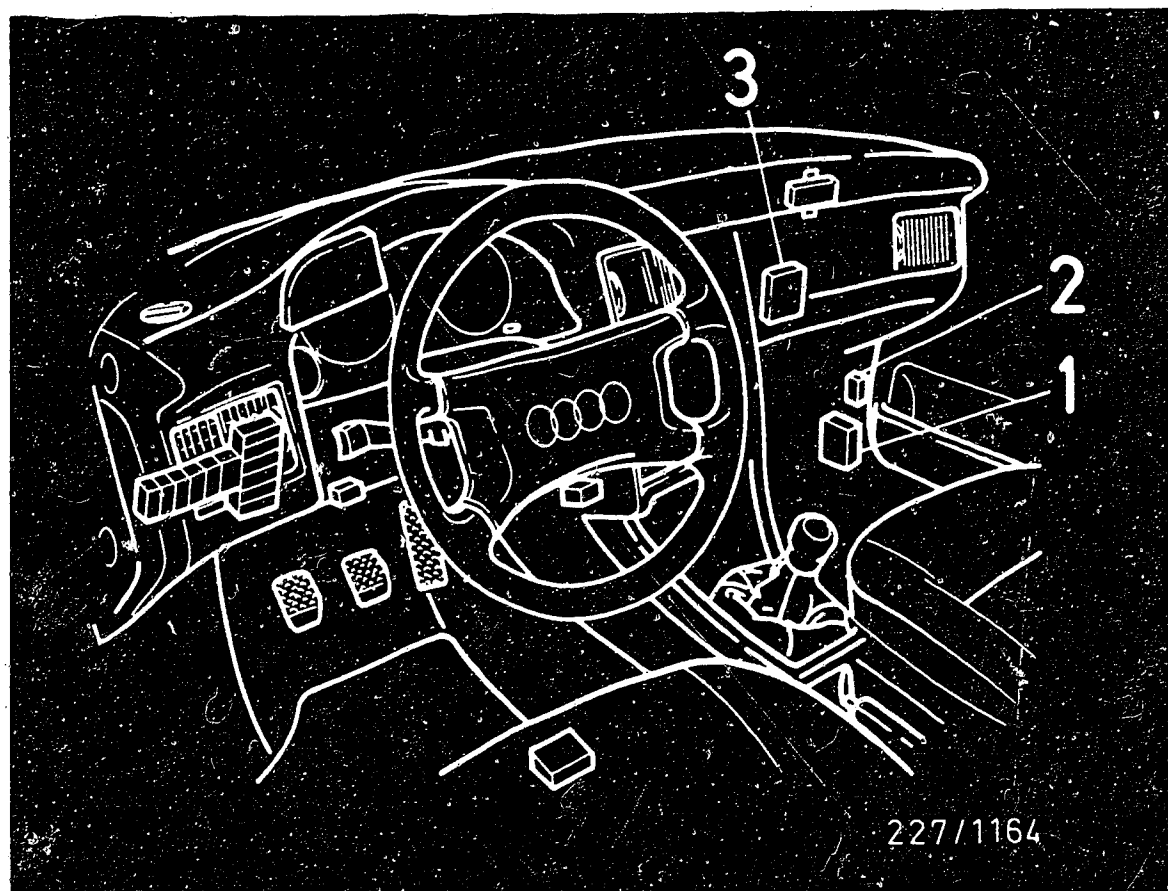
ELECTRICAL TERMINAL DIAGRAM

High-voltage arrows: Danger 400 V...25 kV

A1= Trigger box
 A2= KE-Jetronic control unit
 B1= Magnetic pulse generator
 B2= Knock sensor
 B3= Temperature sensor - coolant
 B4= Air-flow sensor (Pot.)
 B5= Altitude sensor

E1= To ignition distributor
 H1= Fault lamp
 K1= Electric fuel pump relay
 P1= Contacts for diagnosis
 S1= Throttle-valve switch idle/full load

T1= Ignition coil
 X1= EI-K control-unit plug
 X2= Encoding plug
 Y1= Electric fuel pump



- 1 = EI-K control unit
- 2 = Altitude sensor
- 3 = KE-Jetronic control unit

INSTALLATION POSITION OF COMPONENTS

- * EI-K control unit:
in the footwell on the passenger's side (see illus.).
- * Altitude sensor:
in the footwell on the passenger's side above
the EI-K control unit (see illustration).
- * KE-Jetronic control unit:
in the footwell on the passenger's side (see illus.).
- * Variant encoding (if fitted):
in the EI-K control unit.

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Temperature sensor (engine):
near to the spark plug of cyl. 1.
- * Throttle-valve switch (idle/full load):
on the throttle-valve assembly.
- * Trigger box with ignition coil:
next to the battery.
- * Knock sensor:
near to the left-hand engine mounting.
- * Electric-fuel-pump relay:
in the central electrics.
- * Fault lamp:
in the instrument cluster.

Trouble-shooting instructions: AUD-5012
BOSCH system : EI-K
Vehicle make : Audi
Basic microcard : PKW-051

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Audi 5000, 2.3 E, California

Engine 2,3 l, 5 cyl. 100 kW Code letter NF

Year of manufacture 1987

*EI-K control unit 0 227 400 136

*Ignition coil with trigger box 0 221 600 050

*Ignition coil with no trigger box 0 221 122 358

*Version code

*Activate self-diagnosis as follows:

The KE-Jetronic control unit is equipped with a permanent memory. Faults in the EI-K control unit are also stored in this memory. Fault output is separated again according to EI-K and KE Jetronic.

Test prerequisites:

Fuses 13, 19, 24, 28 O.K. Air conditioner off.
Intake-manifold ground connection O.K.

The following test sequence must be maintained:
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(With fault memory cleared, perform test run for at least 5 minutes on road/roller dynamometer at engine speed in excess of 3000 min⁻¹. In doing so, briefly depress accelerator pedal to the full. Or if engine not running, actuate starter for approx. 6 seconds).

Ignition OFF. Ignition ON. Bridge contacts at electric fuel pump relay with fuse for at least 4 seconds. Note down flashing code. Continue bridging contacts until flashing code 0 0 0 0 (end of fault output) appears.
Refer to basic instructions for evaluation of flashing code.

SPECIAL FEATURES (Continued)

Activate KE-Jetronic

This can only be done following EI-K fault output "end".
Bridge contacts for at least 4 seconds.
Note down flashing code (SIS KE-Jetronic).
Continue bridging contacts until flashing code 0 0 0 0 (end of fault output) appears.

Activate final-controlling-element diagnosis

Ignition OFF. Bridge contacts. Ignition ON.
Bridge contacts for at least 4 seconds.
Flashing code indicates which final controlling element is actuated (SIS KE-Jetronic).
Continue bridging contacts until flashing code 0 0 0 0 (end off fault output) appears.
Do not switch off ignition.

Reset fault memory

The fault memory can only be reset following final-controlling-element diagnosis.
Bridge contacts for at least 4 seconds.
The fault memory is r e s e t .
The fault lamp is OFF.
Eliminate fault. Then carry out test run.
Re-activate self-diagnosis (to see whether all faults have been eliminated).

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High-performance ignition system.
Dangerous high and low voltages.

Do not touch voltage-carrying parts or terminals; risk of fatal injury on primary and secondary sides.

*Before carrying out compression testing, remove the control-unit plug or connect ignition coil term. 4 f i r m l y to ground with auxiliary cable.

N o t e : The auxiliary cable must be interference-suppressed to min. 2 k Ω .

For further precautionary measures see the basic instructions.

TROUBLE-SHOOTING CHART

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*			*							High-voltage side
*			*							Ignition coil
*										Firing sequence
*										Voltage - EI-K control unit
*										Ignition-distributor plug and socket
*										Voltage, magnetic pulse generator
*										Function, magnetic pulse generator
*										EI-K control units, function
*										Voltage, trigger box
*										Primary signal
*										Triggering, electric fuel pump relay

TROUBLE-SHOOTING CHART (continued)

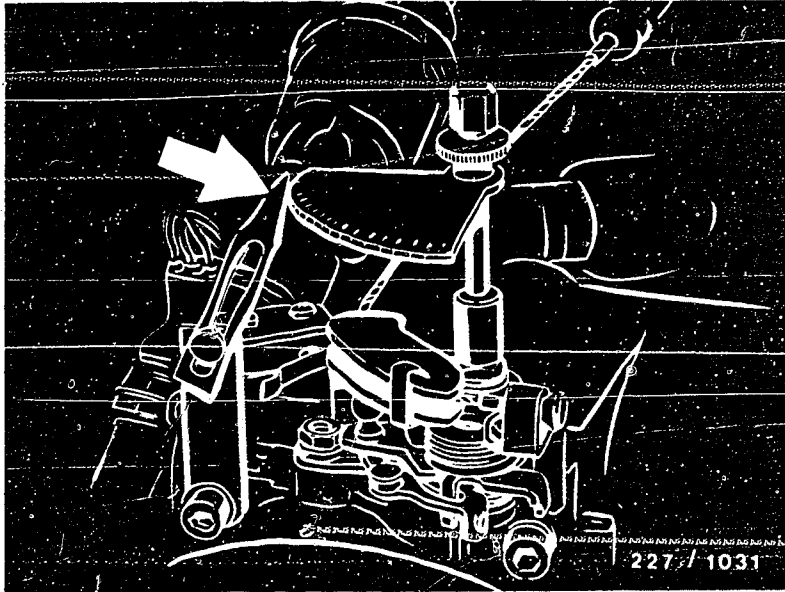
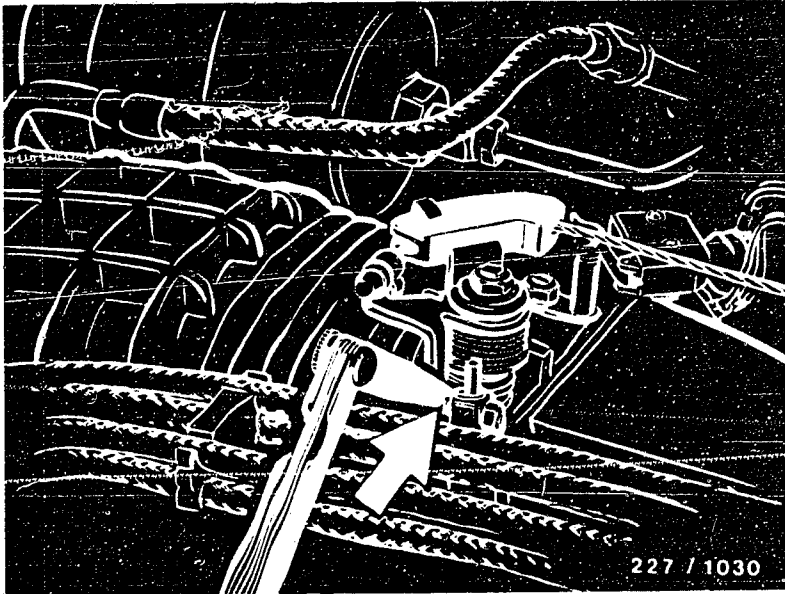
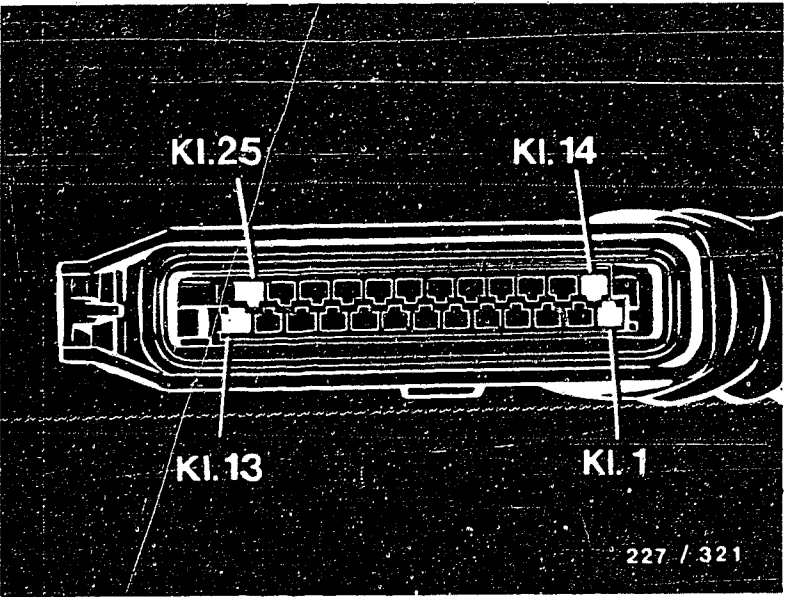
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Cause (component fault)										
*										Contact resistance
*										Ignition distributor installation setting
									*	Fault lamp
*				*	*		*	*	*	Basic ignition setting
			*							Voltage, EI-K control unit
			*							Voltage, ignition coil

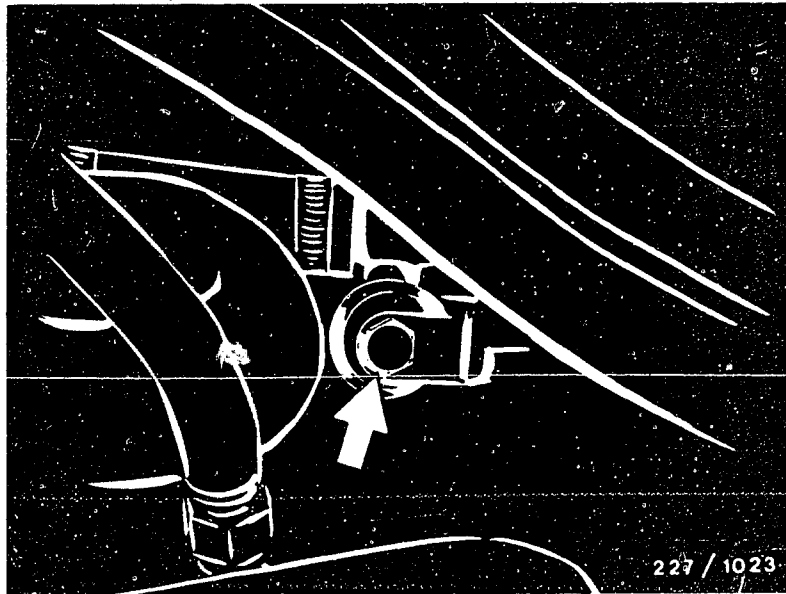
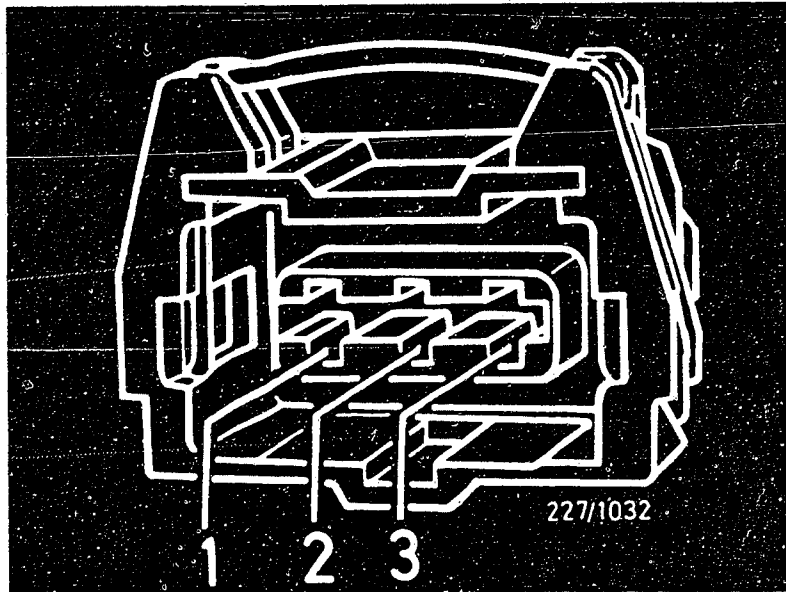
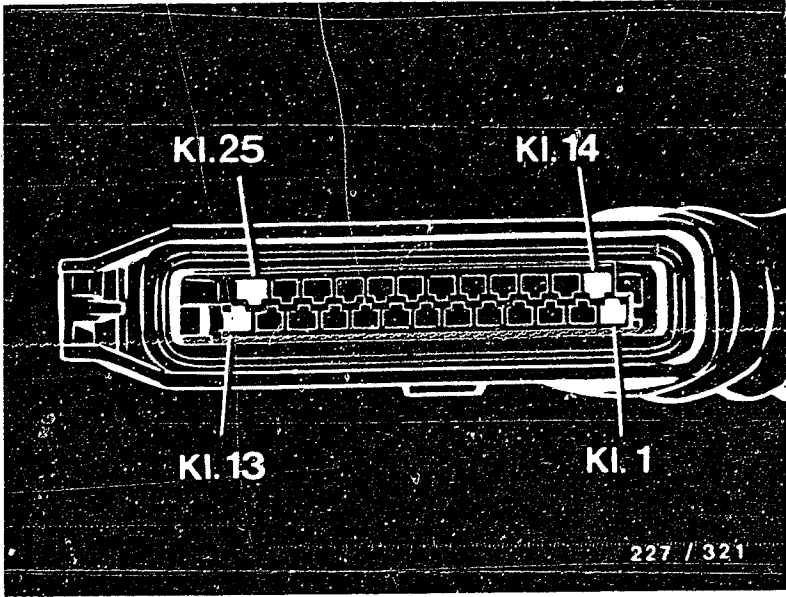
SELF-DIAGNOSIS TEST TABLE

Fault display Flash code	Testing of component/function Test instructions/conditions	Term.	Set values
1 1 1 1	EI-K CONTROL UNIT Replace EI-K control unit.	—	—
2 1 2 1	THROTTLE-VALVE SWITCH - IDLE Voltage, EI-K control-unit plug. Upper illustration. Throttle valve in idle position. Ignition ON. Feeler gauge 0,5...0,7 mm between throttle-valve stop and adjusting screw. See center illustration, arrow.	7 20 (+) (-)	approx. battery voltage 0 V
2 1 2 3	THROTTLE-VALVE SWITCH - FULL LOAD Voltage, EI-K control-unit plug. Throttle valve in idle position. Ignition ON. Graduated disc on throttle valve level 1. See lower illustration, arrow. 68...76° after idle position.	9 20 (+) (-)	0 V approx. battery voltage.



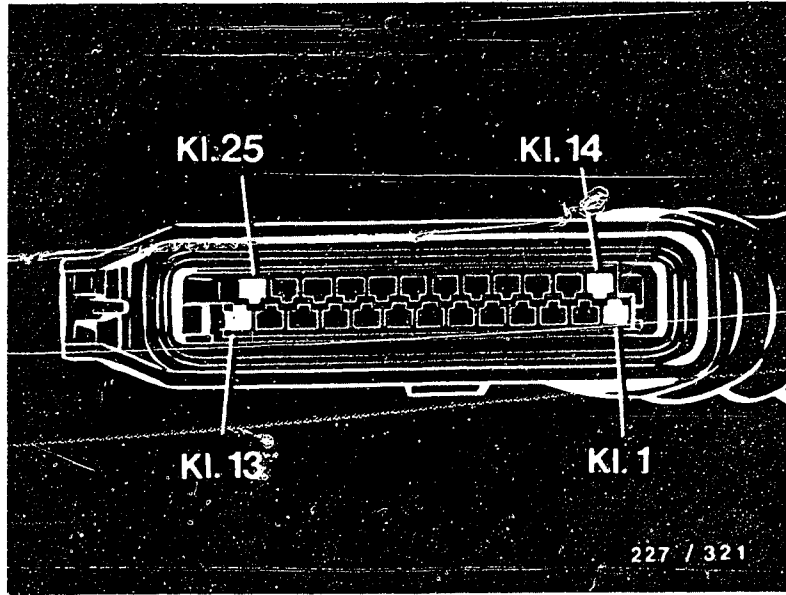
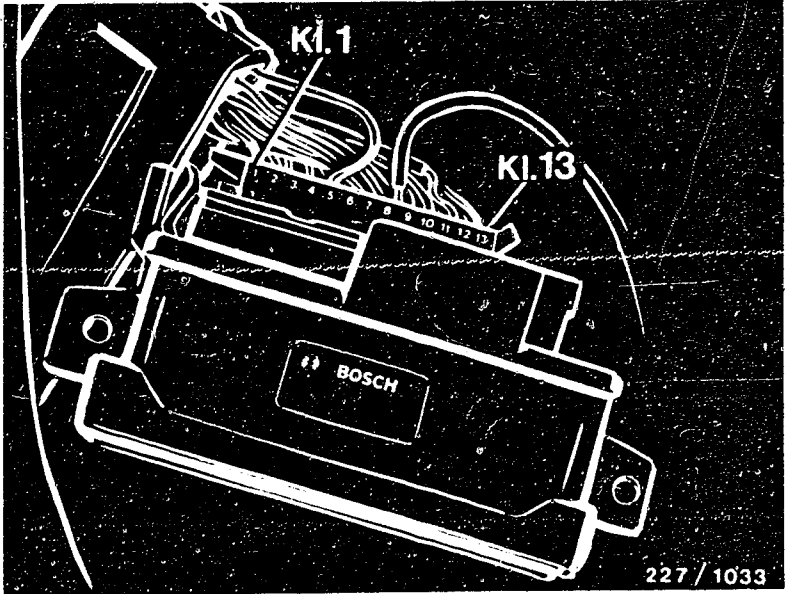
SELF-DIAGNOSIS TEST TABLE (Continued)

Fault display Flash code	Testing of component/function Test instructions/conditions	Term.	Set values
2 1 4 1	MAXIMUM RETARDATION OF KNOCK CONTROL Fuel with insufficient octane number, Check ignition-point adjustment, fuel- injection. Bearing damage, abnormal engine noises.	—	—
2 1 4 2	KNOCK SENSOR Resistance of EI-K control-unit plug (upper illustration) and knock-sensor plug connection (center illustration). Resistance of knock-sensor plug connec. See center illustration. Tightening torque. See lower ill., arrow.	13 1 12 2 12 3 1 2	approx. 0 Ω approx. 0 Ω approx. 0 Ω infinite Ω 15–25 Nm
2 2 2 3	ALTITUDE SENSOR Voltage of EI-K control-unit plug. See upper illustration. Ignition ON.	2 20 (+) (–)	Sea level = 3,2...4,7V 500 m = 2,8...4,0V 1000m = 2,4...3,5V 1500m = 2,0...3,0V 2000m = 1,5...2,5V 3000m = 0,8...1,6V



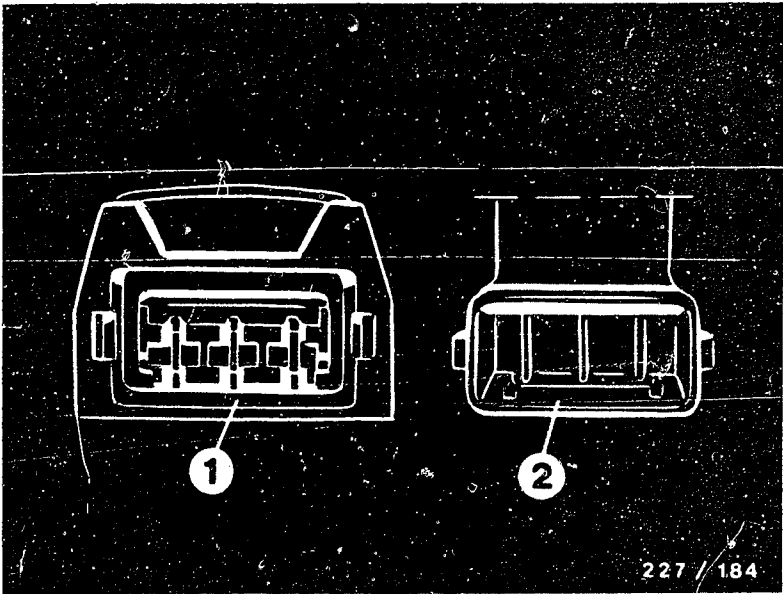
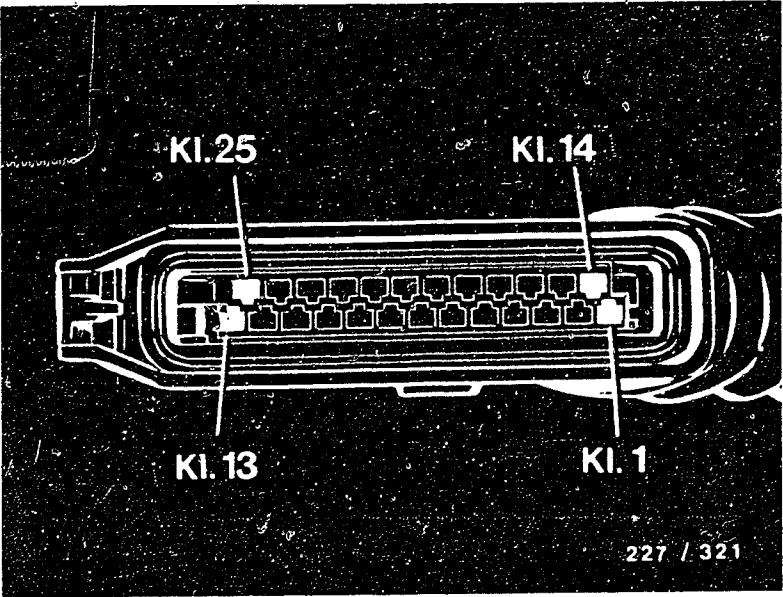
SELF-DIAGNOSIS TEST TABLE (Continued)

Fault display Flash code	Testing of component/function Test instructions/conditions	Term.	Set values
2 2 3 2	LOAD SIGNAL Voltage, EI-K control-unit plug with handle cover removed. See upper illustration. Engine at idle.	8 20 (+) (-)	0,2...4,6 V
2 2 3 3	REFERENCE VOLTAGE FOR LOAD- AND ALTITUDE-SENSOR SIGNAL Voltage, EI-K control-unit plug. See lower illustration. Ignition ON.	21 20 (+) (-)	4,5...5,1 V
2 3 1 2	TEMPERATURE SENSOR - COOLANT Resistance of EI-K control-unit plug. See lower illustration.	25 20	+ 20°C=2,1...2,9k Ω + 30°C=1,4...2,0k Ω + 80°C=280...370 Ω + 90°C=210...280 Ω +100°C=160...210 Ω
4 4 4 4	NO FAULT IN MEMORY	—	—
0 0 0 0	END OF FAULT OUTPUT	—	—



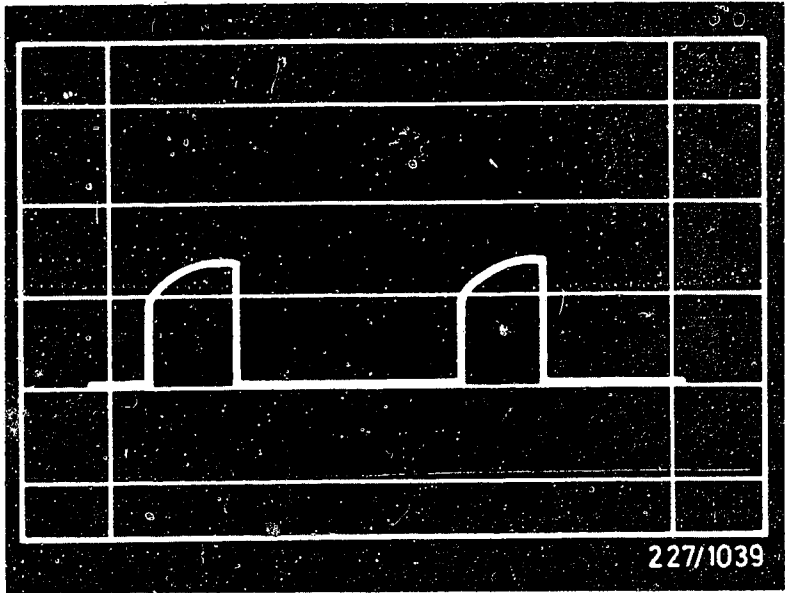
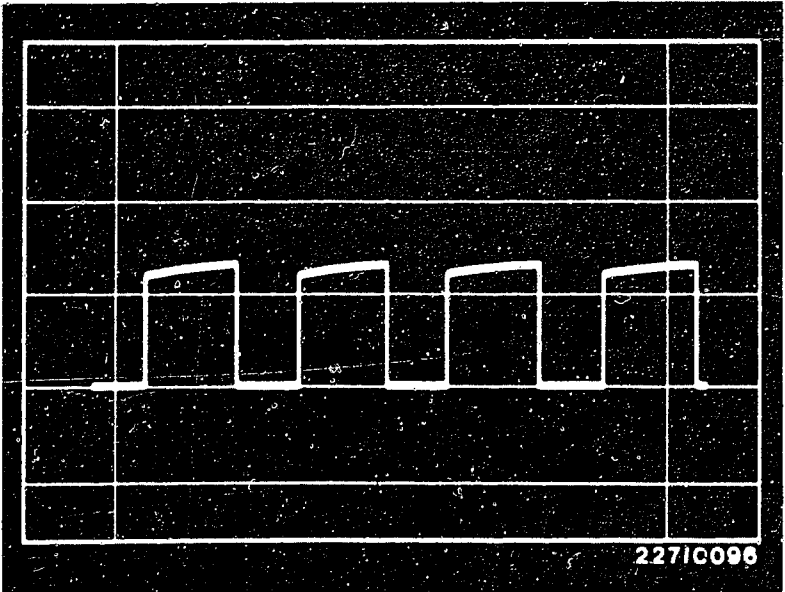
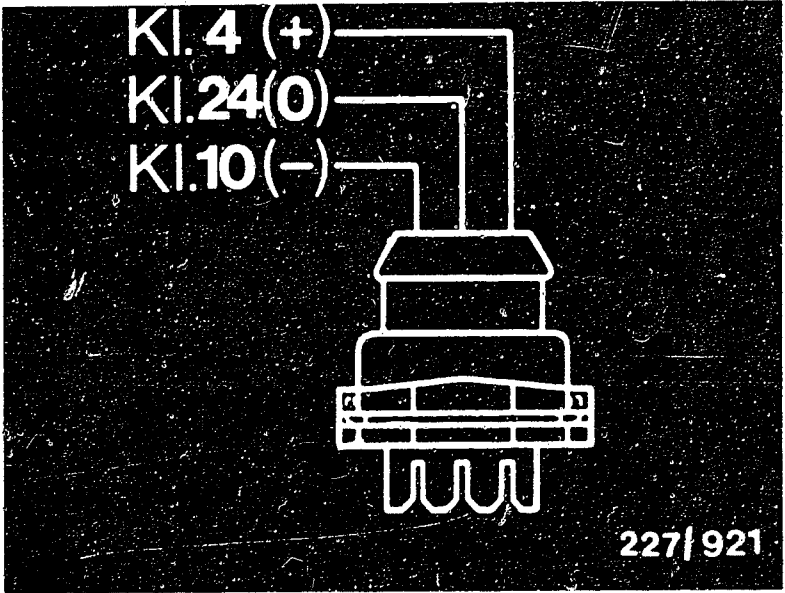
RAPID DIAGNOSIS CHART

Test step	Testing of component/function Test instructions/conditions	Term.	Set values
1	HIGH-VOLTAGE SIDE For example, check spark plugs, ignition harness, distributor cap, etc. for proper operation (e.g. open circuits, shunt). Evaluate with ignition oscillogram, resistance measurement, visual check for example.	—	—
2	IGNITION COIL Visual check (Bosch only): Are seal plugs present, has sealing compound escaped? Primary resistance (Bosch) Secondary resistance (non-Bosch) Primary resistance (Bosch) Secondary resistance (non-Bosch)	— 1 15 1 15 1 4 1 4	— 0,6... 1,0 Ω 0,5... 1,5 Ω 6,4...11,1 k Ω 5,0... 9,0 k Ω
3	VOLTAGE SUPPLY, EI-K CONTROL UNIT Disconnect EI-K control-unit plug. Ignition ON. Voltage of EI-K control-unit plug. See upper illustration.	6 20 (+) (-)	Battery voltage
4	IGNITION-DISTRIBUTOR PLUG AND SOCKET Disconnect ignition-distributor plug. Visual check: Check ignition-distributor plug and socket for oxidation. See lower illustration.	—	—



RAPID DIAGNOSIS CHART (continued)

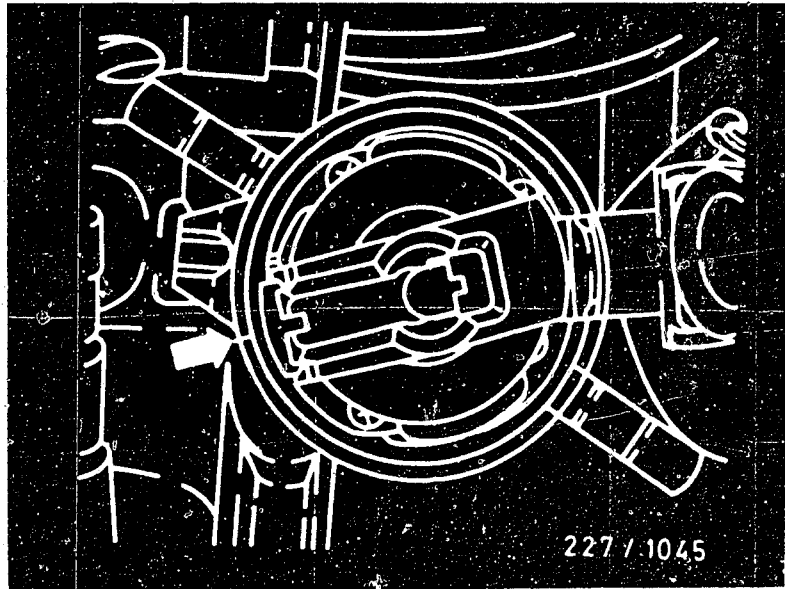
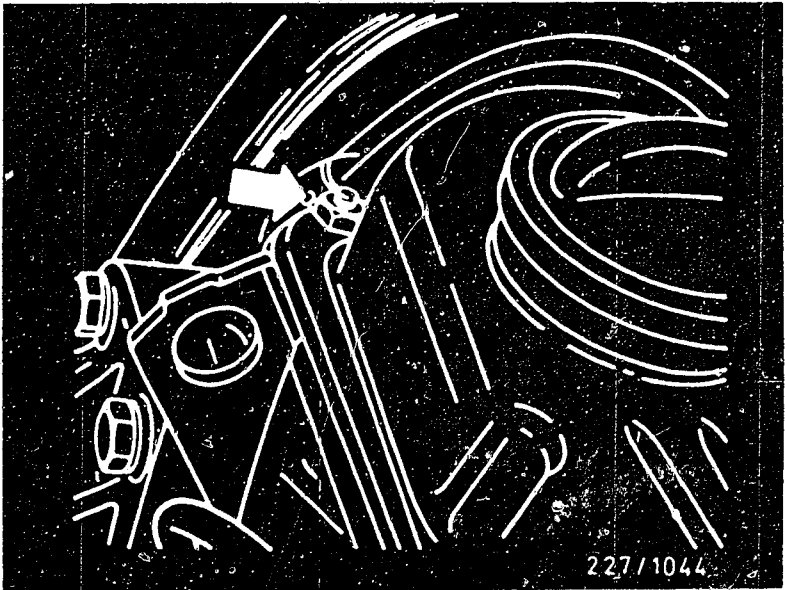
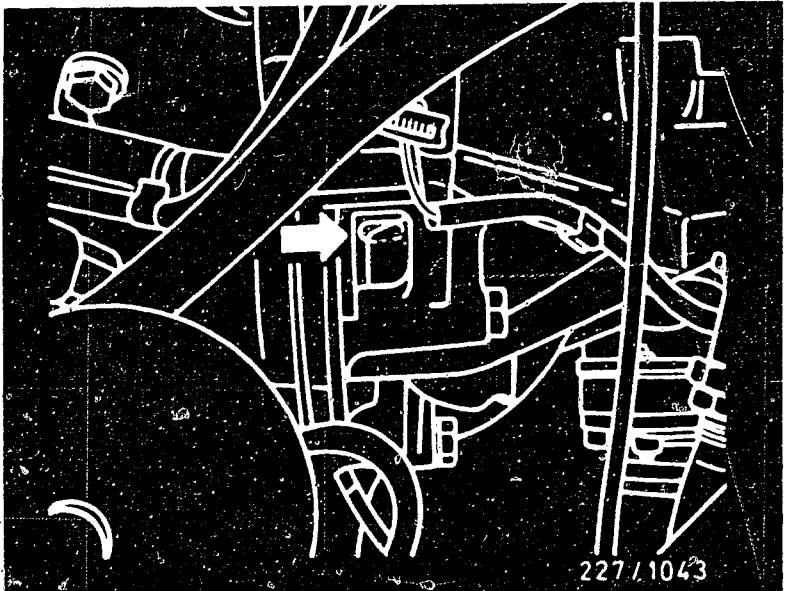
Test step	Testing of component/function Test instructions/conditions	Term.	Set values
5	VOLTAGE SUPPLY, MAGNETIC PULSE GENERATOR Connect ignition distributor and EI-K control-unit plugs. Ignition ON. Voltage, ignition-distributor plug. See upper illustration.	4 10 (+) (-)	equals/above 10 V
6	MAGNETIC PULSE GENERATOR - FUNCTION Start engine. "Special" oscilloscope to ig.-distributor plug. See upper illustration.	24 B- (+) (-)	Rectang. pulse (centre illus.)
7	EI-K CONTROL-UNIT - FUNCTION Trigger-box, ignition-distributor, and EI-K control-unit plugs connected. Start engine. "Special" oscilloscope to trigger-box plug.	2 B- (+) (-)	Rectang. pulse (lower illus.)
8	VOLTAGE SUPPLY, TRIGGER BOX Disconnect trigger-box plug. Ignition ON. Voltage, trigger-box plug.	1 3 (+) (-)	Battery voltage



RAPID DIAGNOSIS CHART (Continued)

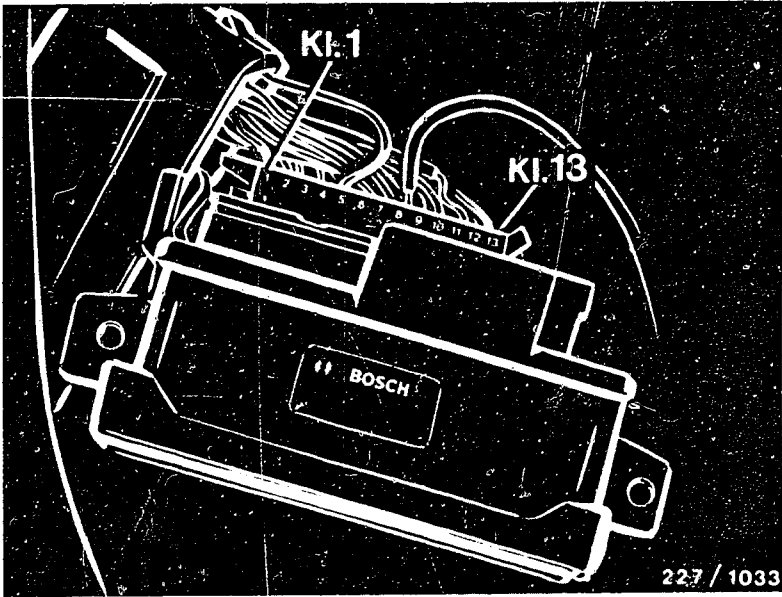
Test step	Testing of component/function Test instructions/conditions	Term.	Set values
9	PRIMARY SIGNAL EI-K control-unit, trigger-box, and ignition-distributor plugs connected. Start engine. Oscilloscope/engine-speed tester to igr. coil.	15 1 (+) (-)	Primary voltage - engine-speed display (level unimportant)
10	TRIGGERING, ELECTRIC FUEL PUMP RELAY Ignition ON. The electric fuel pump relay including the electric fuel pump are triggered (can be heard).	—	Triggering approx. 1 second
11*	CONTACT RESISTANCES Check trigger-box voltage supply leads or primary circuit for contact resistance.	various	max.0,5 Ω
12*	IGNITION-DISTRIBUTOR INSTALLATION SETTING Engine cyl. 1 at TDC. Upper illustration. Camshaft marking aligns with upper edge of valve-cover seal. Center illustration. Middle of distributor rotor points to housing marking. Lower illustration.	—	—
13	FAULT LAMP Ignition ON. Engine at idle.	— —	Fault lamp lights up Fault lamp OFF

* carry out only when engine not running.



RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test instructions/conditions	Term.	Set values
14	BASIC IGNITION SETTING Engine-oil temperature at least 80° C Throttle valve in idle position. Air conditioner switched off. Fault lamp must not be flashing. Bridge contacts on electric fuel pump relay with fuse. Engine at idle. Note: Setting 15 ± 1° before TDC	—	13 - 17° before TDC
15	VOLTAGE SUPPLY, EI-K CONTROL UNIT Voltage at EI-K control-unit plug with handle cover off. Upper illustration. Engine at idle.	6 20 (+) (-)	12 - 14 V max. 2 V below V _B
16	VOLTAGE SUPPLY, IGNITION COIL Engine at idle. Voltage of ignition coil and battery.	15 B- (+) (-)	equals/above 10 V



TEST SPECIFICATIONS

Throttle-valve switch Idle with ignition ON in idle position	Approx. battery voltage
---	-------------------------

Feeler gauge 0,5...0,7 mm between throttle-valve stop	0 V
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Throttle-valve switch - full-load Idle position	0 V
Open throttle valve 68...76° with ignition ON	Approx. battery voltage

Knock sensor Tightening torque	15...25 Nm
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Altitude sensor Sea level	3,2...4,7 V
500 m	2,8...4,0 V
1000 m	2,4...3,5 V
1500 m	2,0...3,0 V
2000 m	1,5...2,5 V
3000 m	0,8...1,6 V

Load signal with engine idling	0,2...4,6 V
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TEST SPECIFICATIONS (Continued)

Reference voltage for load and altitude sensors with ignition ON	4,5... 5,1 V
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Temperature sensor - coolant	+20°C 2,1... 2,9k Ω
	+30°C 1,4... 2,0k Ω
	+80°C 280... 370 Ω
	+90°C 210... 280 Ω
	+100°C 160... 210 Ω

Ignition coil primary (Bosch)	0,6... 1,0 Ω
primary (non-Bosch)	0,5... 1,5 Ω
secondary (Bosch)	6,4...11,1 k Ω
secondary (non-Bosch)	5,0... 9,0 k Ω

Voltage supply, EI-K control unit with ignition ON	Battery voltage
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Voltage supply, magnet pulse generator with ignition ON	Equals/above 10 V
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Magnet pulse generator functioning at cranking speed	Rectangular pulse
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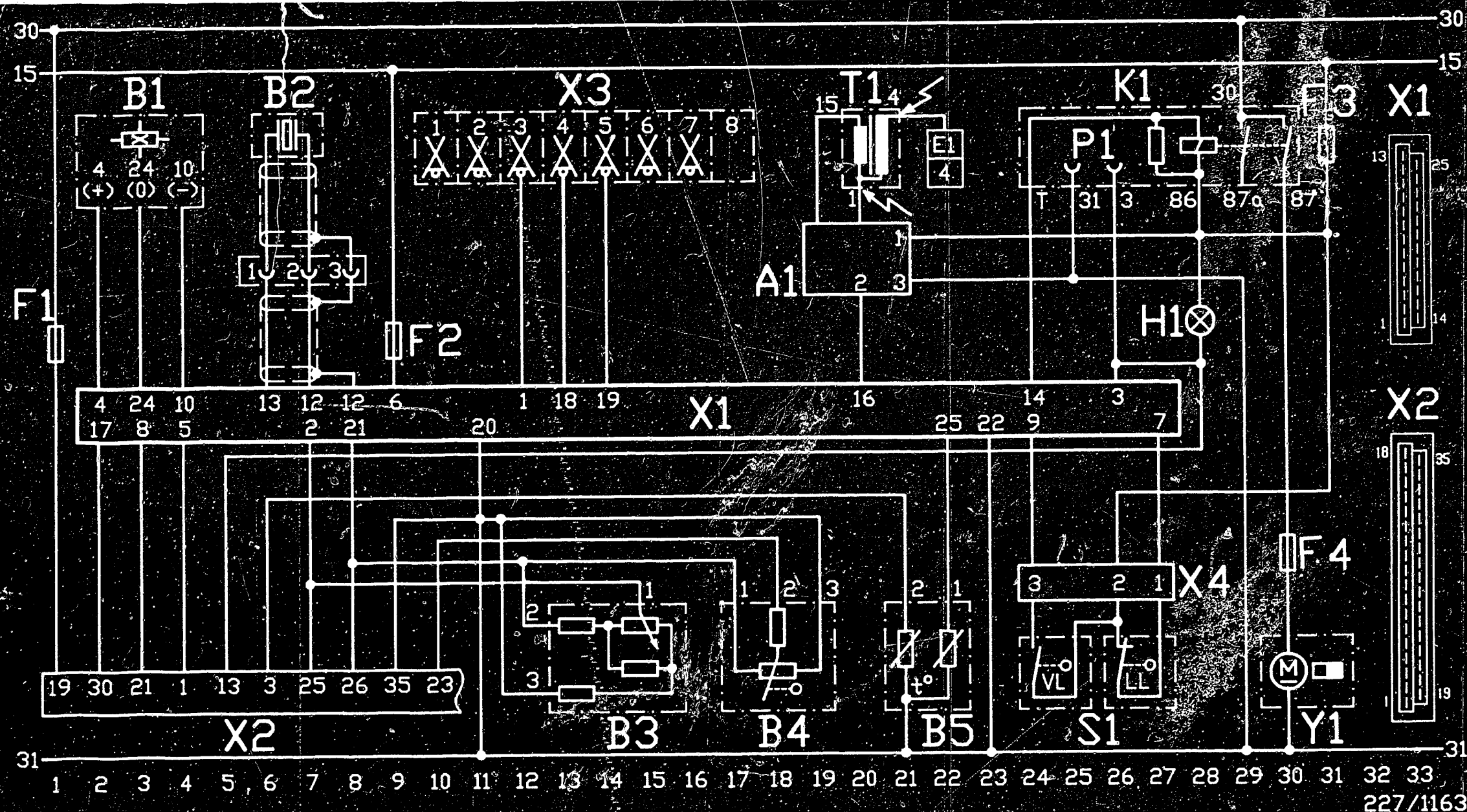
TEST SPECIFICATIONS (continued)

EI-K control unit functioning at cranking speed	Rectangular pulse
Voltage supply, trigger box with ignition ON	Battery voltage
Primary signal at cranking speed	Primary voltage/ engine-speed display
Triggering of electric fuel pump relay with ignition ON	Approx. 1 second (acoustic)
Contact resistance	max. 0,5 Ω
Supply leads, trigger box or primary circuit	
Ignition-distributor installation setting	Cyl. 1 at TDC Igtn.-dist. marking
Fault lamp Ignition ON with engine idling	ON OFF

TEST SPECIFICATIONS (continued)

Basic ignition setting	
Electrical fuel pump relay bridged	
Engine idling	13...17° before TDC (Setting value 15 \pm 1°)
Voltage supply, EI-K control unit Engine idling	12 - 14 V max. 2 V below battery voltage
Voltage supply, ignition coil Engine idling	equals/above 10 V

For setting values for idle speed, exhaust,
valve play, etc. see the Jetronic SIS
microcard or Autodata test specifications.



ELECTRICAL TERMINAL DIAGRAM

High-voltage arrows: Danger 400 V...25 kV

A1= Trigger box
A2= KE-Jetronic control unit
B1= Magnetic pulse generator
B2= Knock sensor
B3= Temperature sensor - coolant
B4= Air-flow sensor (Pot.)
B5= Altitude sensor

E1= To ignition distributor
H1= Fault lamp
K1= Electric fuel pump relay
P1= Contacts for diagnosis
S1= Throttle-valve switch idle/full load

T1= Ignition coil
X1= EI-K control-unit plug
X2= Encoding plug
Y1= Electric fuel pump

B25 — ==>

B26 — <==

INSTALLATION POSITION OF COMPONENTS

The EI-K control unit is located in the footwell on the driver's side.

The altitude sensor is located in the driver's side footwell above the EI-K control unit.

The KE-Jetronic control unit is located in the passenger-side footwell.

Variant encoding unit is located in the footwell on the passenger's side in a plastic case near the KE-Jetronic control unit.

The coolant temperature sensor is located near the spark plug of cyl. 1

The idle/full-load throttle-valve switch is located on the throttle-valve assembly.

The trigger box and ignition coil are located near the windshield-washer fluid container.

The knock sensor is located near the left engine mounting.

The electric fuel pump relay is located in the central electrics box.

The fault lamp is located on the instrument panel.

For production reasons:
continued on the following
coordinate.

Trouble-shooting instructions : BMW-5018

BOSCH system : ASR2 - DKZ / MSR

Vehicle make : BMW

Basic microcard : PKW-081

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Self-diagnosis test table.....	05
Rapid diagnosis chart for universal test adapter.....	07
Electrical terminal diagram.....	13
Installation position of components, notes on removal and installation.....	15

SPECIAL FEATURES

This microcard contains the trouble-shooting instructions for the following models, valid at the time of writing:

BMW 750i, 750iL 8.87->

- * Electronic traction control (ETC2-DKZ/MSR) combined with ABS2.
DKZ = Throttle-valve control and ignition action.
MSR = Engine-drag torque control
- * One common control unit with 55-pin plug for ABS and ETC.
- * ETC control intervenes in both Motronic control units and in E-Gas control unit.
- * A special adapter cable is required for testing. The adapter cable has 2 circular connectors: One for connection to the ABS 2 LED tester for ABS testing and a second connector for connection to the universal test adapter for testing the ETC.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

For a detailed description of trouble-shooting, see the basic instructions.

ATTENTION :
The set values, terminal assignments and special features of these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

*For safety reasons, the hydraulic modulator must not be repaired, but may be replaced only as a complete unit.

Exception: relays.

*Do not loosen any screws on the hydraulic modulator!

Danger due to brake failure.

*Caution when handling brake fluid.
Poisonous!

*Before testing on the chassis dynamometer and on the brake test stand, disconnect ABS/ASR controller plug.

*Tow away with front axle raised only with ignition off.

See basic instructions for further information.

How to activate the self-diagnosis.

+Ignition off.

+Press ASR switch and brake pedal simultaneously.

+Keep pressed and switch on ignition.

+Continue to keep pressed for at least 1 second after switching on the ignition. Then release ASR switch and brake pedal.

+Approx. 3 seconds after ignition has been switched on, ASR indicator lamp starts to flash.

For production reasons:
continued on the following
coordinate.

SELF-DIAGNOSIS TEST TABLE
for BMW-ETC2-DKZ/MSR

Fault indic. Flashing code	Inspection of component / function	Test instructions / test conditions	Termi- nals	Set values
1	No fault stored			—
2	E-Gas control unit. Functions: Throttle- valve presetting, reduc- tion, increase. Lead to term.47. Motronic control unit, functions: Overrun cut- off, spark-advance- angle adjustment.	Test with universal test adapter.	43, 46 47, 48	—
3	Motronic control unit. Function: Blanking-out of ignition pulses	Test with universal test adapter.	45	—
4	Wheel-speed sensor rear left	Perform signal test with ABS LED tester.	30, 29	0,6...1,6 k Ω
5	Wheel-speed sensor rear right	Perform signal test with ABS LED tester.	10, 28	0,6...1,6 k Ω
6	Wheel-speed sensor front right	Perform signal test with ABS LED tester.	32, 12	0,6...1,6 k Ω
7	Wheel-speed sensor front left	Perform signal test with ABS LED tester.	8, 26	0,6...1,6 k Ω
8	Lead to term.45	Test with universal test adapter.	45	—
9	Motronic control unit. Function: Ignition signal term. 1	Test with universal test adapter.	38	—
10	ABS/ETC control unit	Replace ABS/ETC control unit.	—	—

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

Adapter lead: 1 684 463 200

Test step	Switch V	Ω	Termi- nals	Component/function under test	Test instructions/ Test conditions	Set values
1	 V	1	41-18	Shielding of ignition cable	Ignition off.	less than 10 ohm
2.1	4	1	1-18	Power supply to controller	Ignition off.	0 volt
2.2					Ignition on.	10.3...15 volt
3.1	3	1	52-18	Signal from handbrake	Ignition on. Release handbrake.	greater than 7 volt
3.2					Ignition on. Pull on handbrake.	less than 0.5 volt
4.1	7	1	38-18	Lead to Motronic control unit term. 1	Ignition on.	10.3...15 volt
4.2					Ignition off.	less than 0.5 volt
5.1	8	1	48-18	Lead to electronic- accelerator control unit. Throttle-valve increase.	Ignition off.	less than 0.5 volt
5.2					Ignition on.	greater than 7.5 volt
6.1	9	1	46-18	Lead to electronic- accelerator control unit. Throttle-valve reduction.	Ignition on.	greater than 7.5 volt
6.2					Ignition off.	Less than 0.5 volt
7.1	10	1	43-18	Lead to electronic- accelerator control unit. Throttle-valve input (actual value)	Ignition off.	Less than 0.5 volt
7.2					Ignition on. Press accelerator:	Voltage rises
8.1	11	1	54-18	ASR switch	Ignition on.	Less than 0.5 volt
8.2					Ignition on. Press ASR switch:	10.3...15 volt
9.1	11	1	51-18	ASR indicator lamp	Ignition on.	ASR lamp off
9.2					Ignition on. Press button 2:	ASR lamp lit
10	11	1	34-18	Check control: "ASC defective"	Operate engine at idle speed. Perform visual examination of indication in vehicle. Press button 1:	Indication "ASC defective" changes once with indication "operating instructions"; gong sounds.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

Test step	Switch	Ω	Terminals	Testing of component/function	Test instructions/ test conditions	Set values
11	11	1	53 - 18	Check control: "ASC" (signifies ETC is operative)	Run engine at idle speed. Carry out visual check of display in the vehicle. Press button 3:	Display "ASC" indicator symbols flash.
12	11	1	45 - 1	Blanking-out of ignition pulses by Jetronic	Run engine at 2000 min ⁻¹ ; keep accelerator pedal constantly depressed. Actuate button 5 max. 1 seconds. Speed drops to set value and rises again after button 5 is released. Note: If button 5 is actuated for longer than 1 secs. the test cannot be repeated until the ignition has been switched off and then switched on again.	900...1300 min ⁻¹
13	11	1	47 - 1	Spark-advance-angle adjustment by Motronic	Run engine at 2500 min ⁻¹ ; keep accelerator pedal constantly depressed. Actuate button 6 approx. 1...2 seconds. Speed drops to set value and rises again after button 6 is released.	1400...1800 min ⁻¹
14	12	1	42 - 18	Voltage supply (continuous positive to battery)	Ignition off.	10,3...15 V

Final test

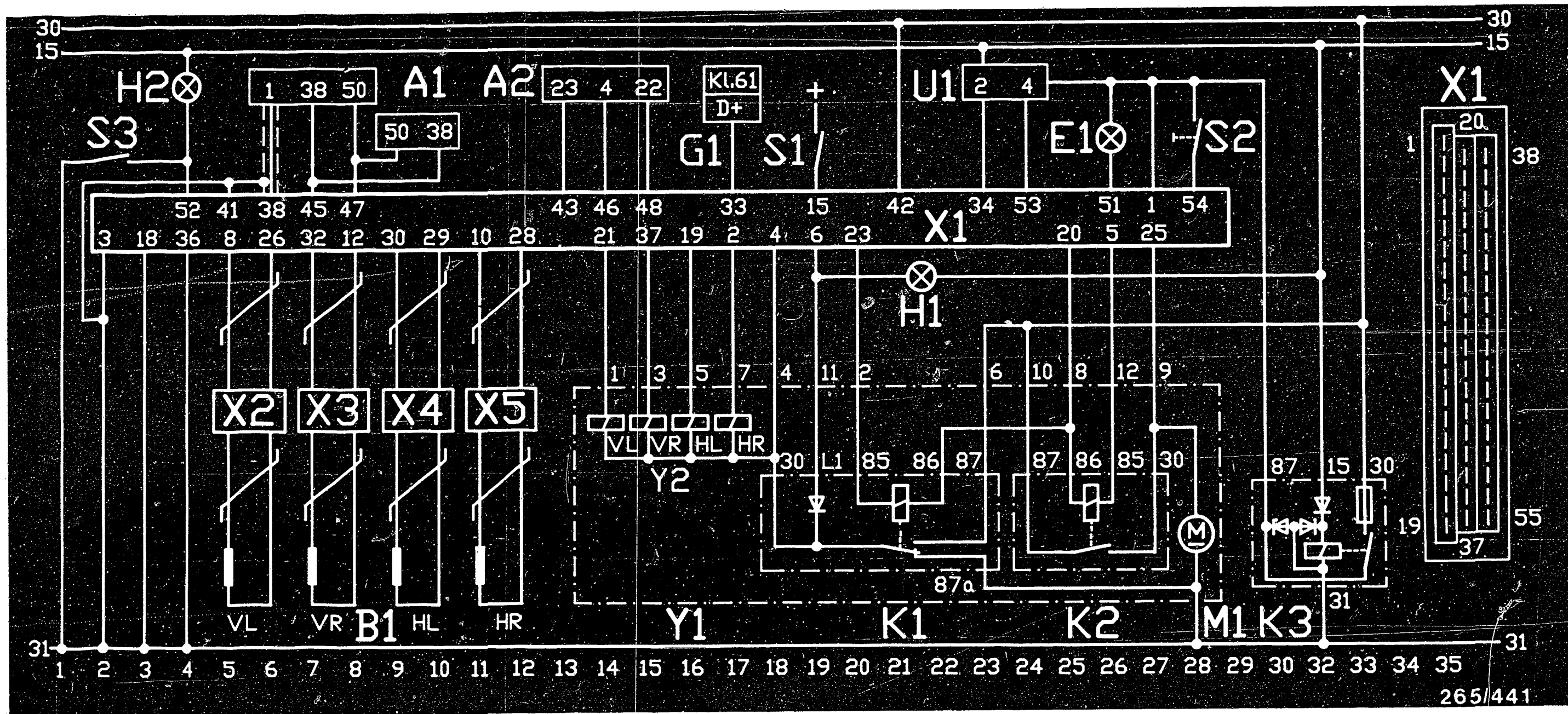
Connect all control units.

Switch on ignition: ASR repeater lamp must light up. No indication by check control.

Start engine and run at high speed:
ASR repeater lamp continues to light up.
No indication by check control.

Take for a test drive:
Drive for at least 20 seconds at a speed exceeding 30 km/h and for 3 seconds at at least 50 km/h.
ASR repeater lamp must continue to light up.
No indication by check control.

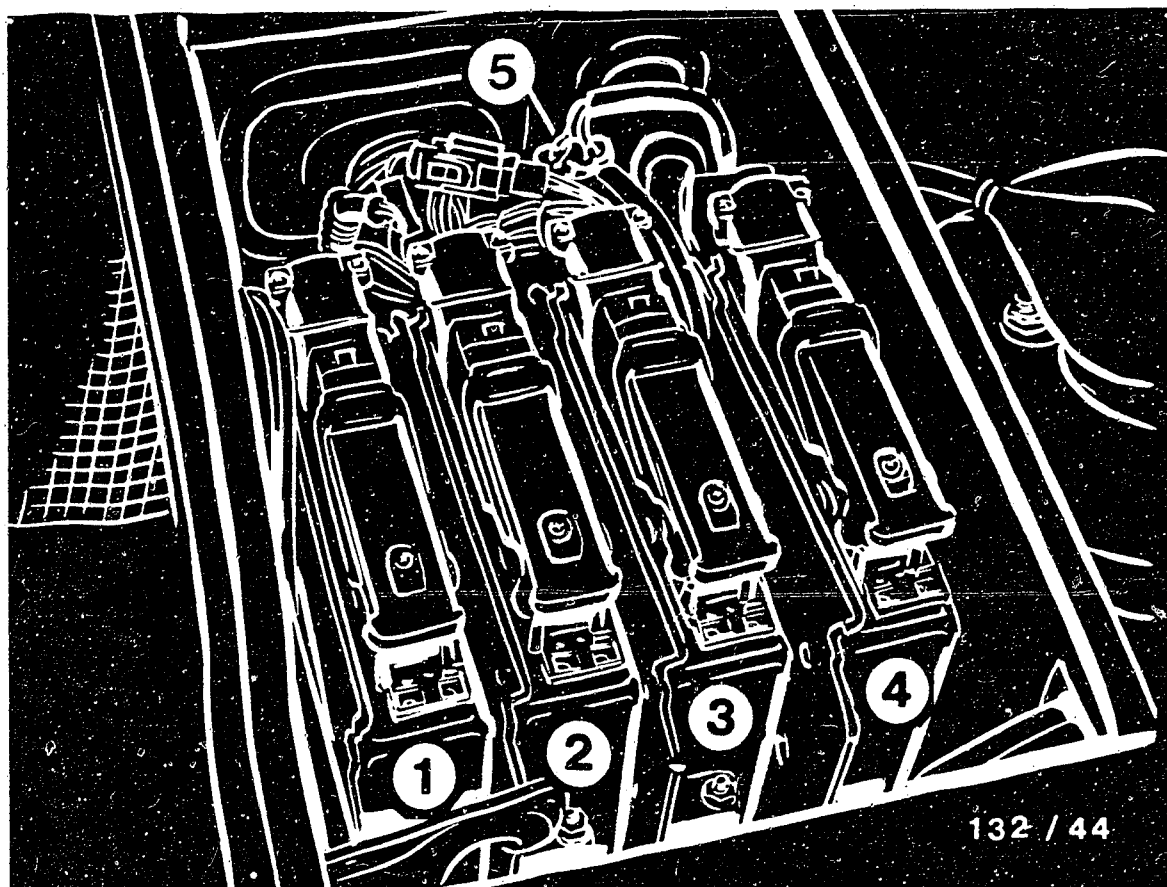
For production reasons:
continued on the following
coordinate.



A1 = Motronic control units
 A2 = E Gas control unit
 B1 = Wheel-speed sensor
 E1 = ASR repeater lamp
 G1 = To alternator term. 61/D+
 H1 = ABS warning lamp
 H2 = Hand-brake indicator lamp
 K1 = Valve relay
 K2 = Motor relay
 K3 = Overvoltage-protection relay
 M1 = Pump motor

S1 = Stop-lamp switch
 S2 = ASR nonlocking switch
 S3 = Hand-brake switch
 U1 = Check Control (blue plug)
 X1 = ABS/ASR controller plug
 X2, X3, X4, X5 = Wheel-speed sensor plugs
 Y1 = Hydraulic modulator
 Y2 = Solenoid-operated valves
 HL, HR = Rear left, rear right
 VL, VR = Front left, front right

ELECTRICAL TERMINAL DIAGRAM BMW 750 1 (L) 9.87->

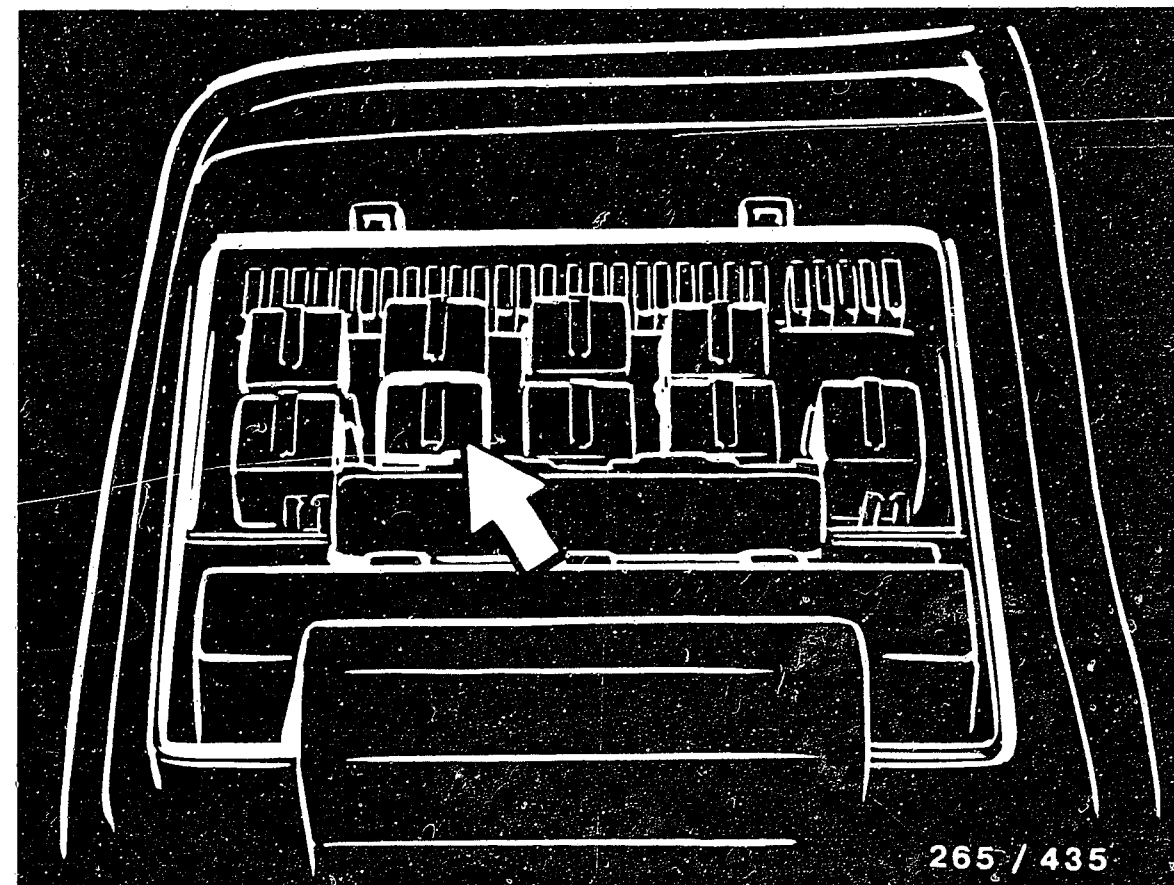


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- 1 = Motronic control unit
Bank 1
- 2 = E-Gas control unit
- 3 = Motronic control unit
Bank 2
- 4 = ABS/ETC control unit

INSTALLATION POSITION OF COMPONENTS

- * ABS/ETC control unit (Item 4):
In equipment compartment beneath the hood.
Unscrew cap.
Detach connector:
Lift up unlatching clip and detach connector on wiring
harness side from mechanical coding.

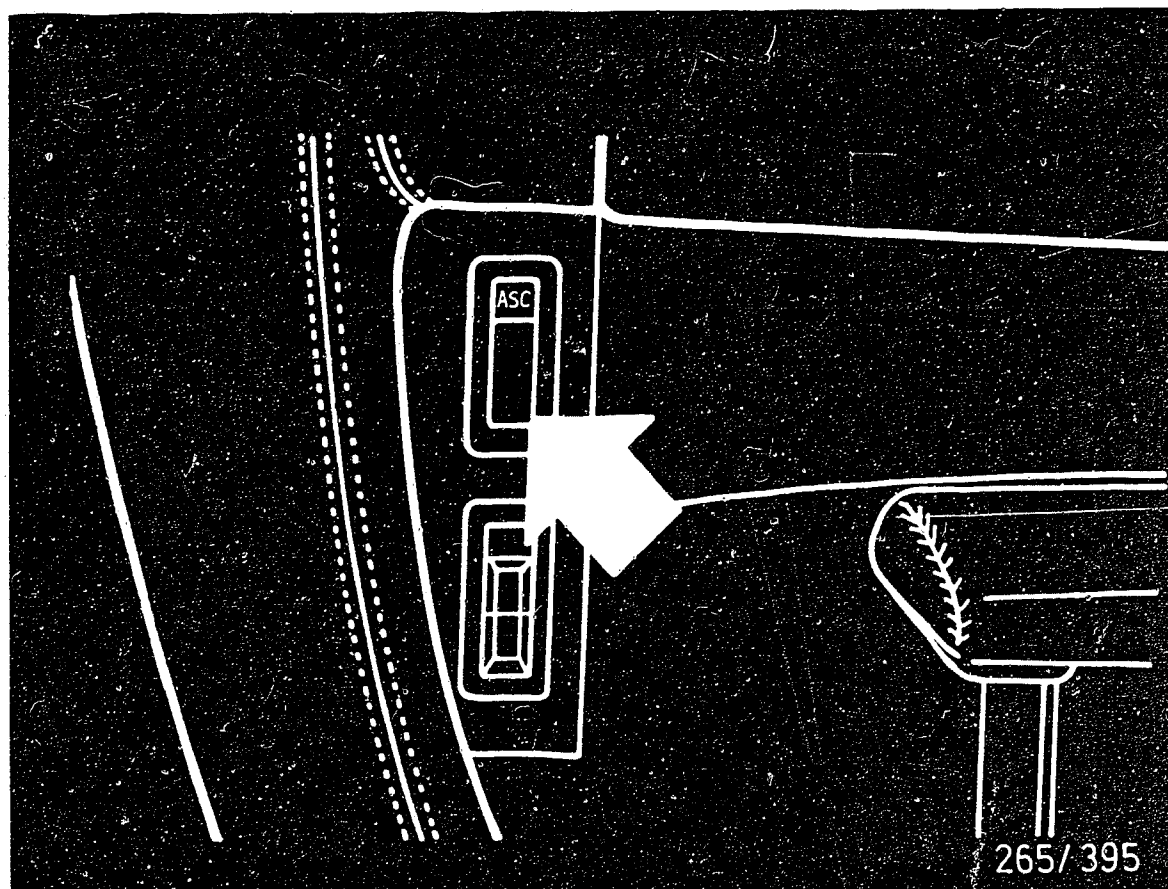


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- 1 = Overvoltage-protection relay

INSTALLATION POSITION OF COMPONENTS (Continued)

Overvoltage-protection relay:
In the fuse and relay box. Relay box in the engine
compartment on the left-hand side in front of the
firewall.



Arrow = ASR repeater lamp and ASR nonlocking switch

INSTALLATION POSITION OF COMPONENTS (Continued)

ASR repeater lamp and ASR nonlocking switch:
In the passenger compartment in the center console.

ASR warning indication and ASR information
via check control in instrument panel.

Ground terminal:
In the engine compartment at the control-unit
box on the left-hand side beneath a cover.

For production reasons:
continued on the following
coordinate.

Trouble-shooting instructions : OPE-5010
BOSCH system : Motronic M2.5
Make of vehicle : OPEL
Basic microcard : PKW-050

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Installation position of components, notes on removal and installation	25

SPECIAL FEATURES

These trouble-shooting instructions apply to the following vehicle models, valid at the time of writing:

- OPEL Kadett GS1 16V (2.88 ->)
with 2.0-l / 4-cylinder engine,
16 valves,
engine type OHC, 20 XE, C 20 XE
- * Motronic M 2.5 with self-diagnosis
 - * Control unit with 55-pin plug
 - * Hot-wire air-mass meter with CO potentiometer. Temperature sensor for intake air not required.
 - * Knock control integrated in Motronic control unit.
 - * Phase sensor (Hall generator) in ignition distributor for sequential injection, i.e. each injection valve is individually energized via its own output stage.
 - * One common sensor for engine speed and reference mark.
 - * Single-winding rotory actuator.
 - * Lambda closed-loop control.
 - * Tank ventilation system.
 - * Ignition coil is actuated via external output stage.
 - * Variant coding for adaptation to national variants with and without catalytic converter and for influencing engine speed and mixture.

Variant coding with coding plug on wiring-harness side.

Engines with catalytic converters, designed for 95 RON unleaded, may also in emergencies be run on 91 RON unleaded.

Engines (without catalytic converter) which are designed for 98 RON may also in emergencies be run on 95 RON unleaded.

Octane number	Coding plug with resistance at term. 46 and ground		Version for Switzerland only with catalytic converter, term.20 open *)
	term.20 open	term.20 to ground	
95 RON with cat.	220 or 470 Ω 1)	not permissible	0 Ω 1)
	750 Ω 2)3)		4700 Ω 2)3)
	1200 Ω 3)		infinity Ω 2)
	2200 Ω 2)		
98 RON without cat.	not permissible	750 Ω 2)3)4)	not permissible
		1200 Ω 3)4)	
		2200 Ω 2)	

95 RON = premium-grade gasoline, unleaded

98 RON = premium-grade gasoline, leaded

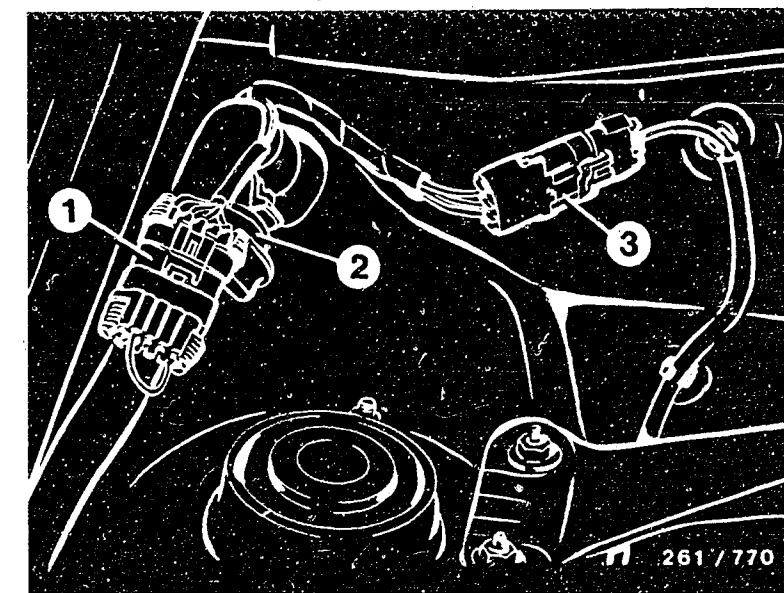
*) If term.20 is connected to ground, there is no injection.

1) Basic value

2) Idle speed is raised by 100 min $^{-1}$

3) Acceleration enrichment is made richer.

4) Mixture is made richer: Lambda +4.7% is equivalent to approx.1% CO.



- 1 = Diagnostic plug
- 2 = Coding plug (term.46)
- 3 = Lambda-sensor plug

Check voltage supply (Motronic relay) to control unit.

- * Switch off ignition.
- * Detach control-unit plug.

1. Connect voltmeter to term.18 (+) and term.19 (-).

- * Switch on ignition.

Set value: battery voltage.

If set value is not obtained:

- * Check positive lead to B+.
- * Check ground lead and ground terminal.

2. Jumper term.19 and term.36 at connector.

- * Connect voltmeter to term.37 (+) and term.19 (-).

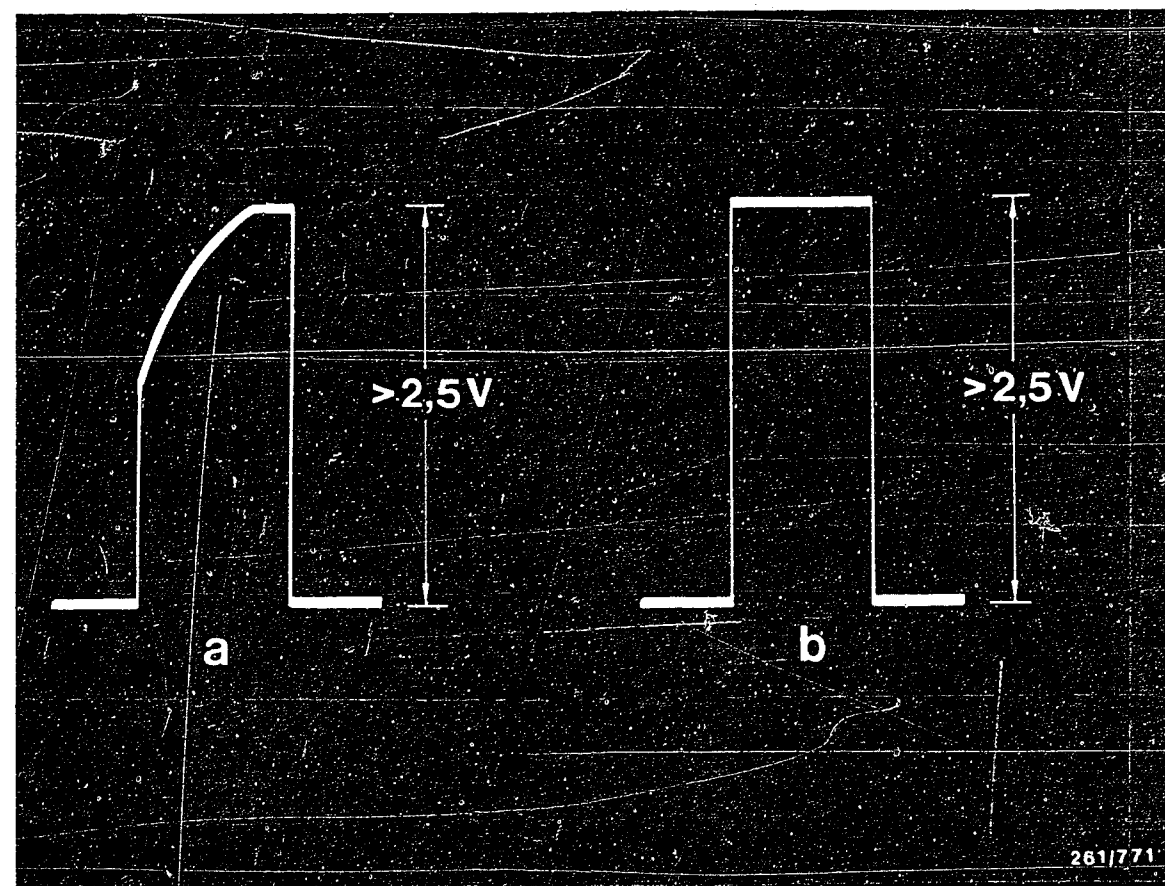
Set value: battery voltage.

If set value is not obtained:

- * Check following leads to Motronic relay:
 - * From B+ to term.30 and term.86.
 - * From control-unit plug term.36 and term.37 to term.85 and term.87 respectively.

- * Motronic relay defective.

- * If leads, plug connections and relays are OK and the voltage supply still does not function, control unit defective.



a = Actuating signal with ignition output stage connected.

b = Actuating signal with resistance to ground.

Test ignition output stage.

Perform test if no primary signal is present at ignition coil term.1.

1. Test ignition coil and leads as follows:

Measure battery voltage and ignition coil term.1 with ignition switched on. If OK, continue test.

2. Test actuating signal of ignition output stage.

- * Control-unit plug and plug on ignition output stage inserted.
- * Push back rubber sleeve on plug of ignition output stage.
- * Connect special input of oscilloscope to term.4 of ignition output stage.
- * Start engine and observe signal.

Test ignition output stage (continued)

Set value: Amplitude of rectangular signal (illustration a) must be greater than 2.5 V

If set value is not obtained:

- * Detach plug from ignition output stage. Connect voltmeter to term.3 (+) and term.2 (-). Switch on ignition. Set value: battery voltage. If set value is not obtained: Test leads to driving switch term.15 and to ground. If leads are OK, continue with test.

- * At detached plug, connect resistor with 220 Ω at term.4 to ground. Start engine and observe signal. Set value: amplitude of rectangular signal (illustration b) must be greater than 2.5 V. If set value is not obtained: Check lead to control unit term.1. If lead is OK, control unit defective. If set value is OK: replace ignition output stage.

Test phase sensor (Hall generator)

- * Phase sensor and control unit connected.
- * Push back rubber sleeve from sensor plug.

1. Voltage supply.

Connect voltmeter to term.3 (+) and term.1 (-). Switch on ignition. Set value: higher than 10 V.

Set value not obtained:

- * Detach plug from phase sensor and measure voltage again. Voltage now OK, replace phase sensor. If set voltage value is still not obtained, check leads to control unit term.1 and to ground. If leads and plug-in contacts are OK, replace control unit.

2. Phase-sensor signal.

- * Connect special input of oscilloscope to sensor plug term.2 (signal) and ground. Start engine. Rectangular signal must appear on oscilloscope. (Signal width is dependent on engine speed. Wide signal for low engine speed.) If no rectangular signal visible, replace phase sensor.

Testing hot-wire air-mass meter:
Burn-off function.

- * Hot wire must be visible.
- * Run warmed-up engine for short period at over 2000 min⁻¹. Switch off engine. Approx. 4 seconds after engine stops, hot wire glows for approx 1.5 seconds.

Hot wire does not glow:

- * Check lead from control unit term.25 to air-mass meter term.4 for open circuit and short circuit to ground.
- * Detach connector from air-mass meter and connect voltmeter to connector terminals 4 (+) and 1 (-). Repeat test for burn-off function. Instead of the hot wire glowing, a voltage must be measured.
Set value: approx. 5 V
- * If no voltage is measured, control unit defective.
- * If voltage reaches set value, air-mass meter defective.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults. For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

Avoid fuel injection while testing the compression!
Disconnect the Motronic relay.

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

											Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*											Voltage supply, relay
*											Pick-up
*	*	*				*					Temperature sensor, engine
*		*			*	*					Fuel pressure
*		*				*	*				Solenoid-operated injection valves
		*	*								Idle contact
					*						Full-load contact
	*	*	*	*	*	*					Air-mass meter
	*	*	*								Idle actuator
*	*	*	*								Air intake system
		*									Idle speed
*		*		*	*						Ignition coil
*				*							Ignition output stage
*		*	*	*	*						Primary signal
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*		*	*		Ignition point
		*									Exhaust gas
		*									Overrun cutoff
	*	*	*								Interference-suppression resistors
					*						Interference

Customer complaint (Fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

[illegible]

SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Inspection of component/function	Test instructions/test conditions	Terminals	Set values
1 2	Control unit/flashing-code output OK	Ignition on: Fault lamp lights up. Flashing-code output not functioning if fault lamp, supply leads to fault lamp and to diagnostic plug and power supply to control unit including term. 18 are defective. If wiring harness is OK, but no flashing code is output, control unit defective.	13, 22	—
1 3	Lambda sensor/voltage change	Check leads to lambda sensor for open circuit.	10(-), 28	—
1 4 1)	Temperatur sensor (engine)/short circuit to ground	Check temperatur sensor and lead for short circuit to ground.	45	—
1 5 1)	Temperatur sensor (engine)/open circuit or short circuit to battery voltage	Check temperatur sensor and leads for open circuit or contact with battery positive. Temperatur-sensor resistance: at + 15...+30°C : at approx. +80°C :	45, ground	1450...3300 Ω 280...360 Ω
1 6	Knock sensor/operation, open circuit and short circuit to ground	Check knock-sensor leads for open circuit or short circuit to ground and plug for corrosion and faultless contacting. Check knock-sensor tightening torque:	11, 30	15...25 Nm
1 8	Knock-control module in control unit	If knock sensor, leads and plug-in connections are OK, exchange Motronic control unit.	11, 30	
2 5 2 6 2 7 2 8	Injection valves/short circuit to battery voltage	Check leads for short circuit to battery voltage. Pay attention to chafing points. Flashing code 25 applies to injection valve cyl. 1, 26 applies to cyl. 2, 27 applies to cyl. 3, 28 applies to cyl. 4. Resistance of injection valve:	17 16 35 34	14.5...17 Ω

1) Currently not assigned.

SELF-DIANGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Inspection of component/function	Test instructions/test conditions	Terminals	Set values
4 4	Lambda sensor/short circuit to ground	Check lead for short circuit to ground. Pay attention to chafing points. Very lean, e.g. tank run dry.	28	—
4 5	Lambda sensor/short circuit to battery voltage	Check lead for short circuit to battery voltage. Pay attention to chafing points.	28	—
4 8	Supply voltage for control unit too low (with engine running)	Supply voltage: Check voltage drops at positive and ground terminals. Charge battery. Check generator system.	37(+), 19(-),	higher than 10 V
4 9	Supply voltage for control unit too high (with engine running)	Supply voltage: Check generator regulator.	37(+), 19(-),	lower than 16 V
5 1	Control unit/digital section	Control unit defective	—	—
6 5 2)	Potentiometer for idle CO adjustment/voltage too low (lower than 0.25 V)	Potentiometer must not be at left-hand stop. Measure resistance of potentiometer. Check lead for short circuit to ground.	43	Resistance at air-mass meter between term. 1 and term. 6: Minimum 0 ... 30 Ω Maximum: 900...1100 Ω
6 6 2)	Potentiometer for idle CO adjustment/voltage too high (higher than 4.8 V)	Measure resistance of potentiometer. Check potentiometer and leads for open circuit and short circuit to battery voltage.	43	

2) Applies to vehicles without catalytic converter only.

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Inspection of component/function	Test instructions / test conditions	Termi- nals	Set values
6 7	Throttle-valve switch/ idle contact	Fault: Idle contact constantly closed or short circuit to ground. Idle contact closed in inoperated position: Actuate throttle valve slightly:	52, ground	0 Ω infinity Ω
7 2	Throttle-valve switch/ full-load contact	Fault: Full-load contact constantly closed or short circuit to ground. Fault lamp lights up only at times in overrun operation. Full-load contact closed in full-throttle position: Apply less pressure to accelerator pedal:	53	0 Ω infinity Ω
7 3	Air-mass meter/no signal or voltage supply	Check leads to term. 3 (signal) and term. 5 (battery voltage) for open circuit. Term. 3 has short circuit to ground. Air-mass meter defective.	7	—
7 4	Air-mass meter/signal has short circuit to battery voltage, no ground potential	Check lead to term. 3 for short circuit to battery circuit. Check both ground leads (term. 1 and term. 2) for open circuit. Air-mass meter defective.	7, 26(-), 2nd ground	—
7 5	Engine intervention by electronic transmission control. Short circuit to ground	Check lead for short circuit to ground. Continue test with electronic transmission control, if fitted.	51	—
8 1 8 2 8 3 8 4	Injection valves/short circuit to ground or open circuit	Check leads for short circuit to ground and open circuit. Resistance of injection valve: Flashing code 81 applies to injection valve cyl. 1, 82 applies to cyl. 2, 83 applies to cyl. 3, 84 applies to cyl. 4. Open circuit in positive lead to relay term. 87.	17 16 35 34	14.5...17 Ω

TEST SPECIFICATIONS

Pressure regulator

* Fuel pressure 2,3...2,7 bar

Electric fuel pump

* Fuel delivery
(measured in return) min. 850 cm³ /30s
Supply voltage
(under load): min. 12 V

Temperature sensor (engine),

Plug color blue.

* Electrical internal resistance
at ambient temperature
(+ 15° C...+ 30° C): 1450...3300 Ω
engine at operating temperature
(approx. + 80° C): 280... 360 Ω

Solenoid-operated injection valve

* Electrical internal resistance
at ambient temperature
(+ 15° C...+ 30° C): 14,5... 17 Ω

Hot-wire air-mass meter

* Resistance value between
term.1 and term.2 (ground terminals): 0 Ω
term.2 and term.3 (measurement resistance):
2,5...3,1 Ω
term.2 and term.6 (CO potentiometer):
0...1100 Ω

TEST SPECIFICATIONS (CONTINUED)

Engine-speed sensor and reference-mark sensor

* Electrical internal resistance
at ambient temperature
(+15°C...+30°C): 400...800 Ω
* Air gap: 0,8 ±0,5 mm

Throttle-valve switch

* Resistance value of idle
contact (term.18 and term.2): approx. 0 Ω
* Resistance value of full-load
contact (term.18 and term.3) approx. 0 Ω

Interference-suppression resistors (high-voltage side)

* High-voltage-distributor rotor: 1 k Ω
* Plug on high-voltage-distributor
dome and on ignition coil each 1 k Ω
* Spark-plug connector each 1 k Ω

Knock sensor

* Tightening torque 15...25 Nm
Fit knock sensor without tooth
lock washer and spring lock washer.

Idle actuator

* Electrical internal resistance
at +15°...+30°C : approx. 8 Ω

Lambda sensor

* Resistance value of heating coil 1...15 Ω

Tank-ventilation valve (not from Bosch)

* Electrical internal resistance
at +15°C...30°C : approx. 28 Ω

Ignition coil

* Primary resistance 0,6...1,0 Ω
* Secondary resistance 6400...11100 Ω

TEST SPECIFICATIONS (CONTINUED)

Idle test:

Engine at operating temperature,
switch off loads.

- * Idle speed: 940 \pm 50 min⁻¹ +)
- * Spark-advance angle: 20 ° crankshaft

CO content:

- * Without catalytic converter: 0,7...1,2 % by vol. CO

+)

adjust mixture at
CO potentiometer in air-
mass meter:

Turning counter-clockwise produces leaner mixture,
turning clockwise produces richer mixture.

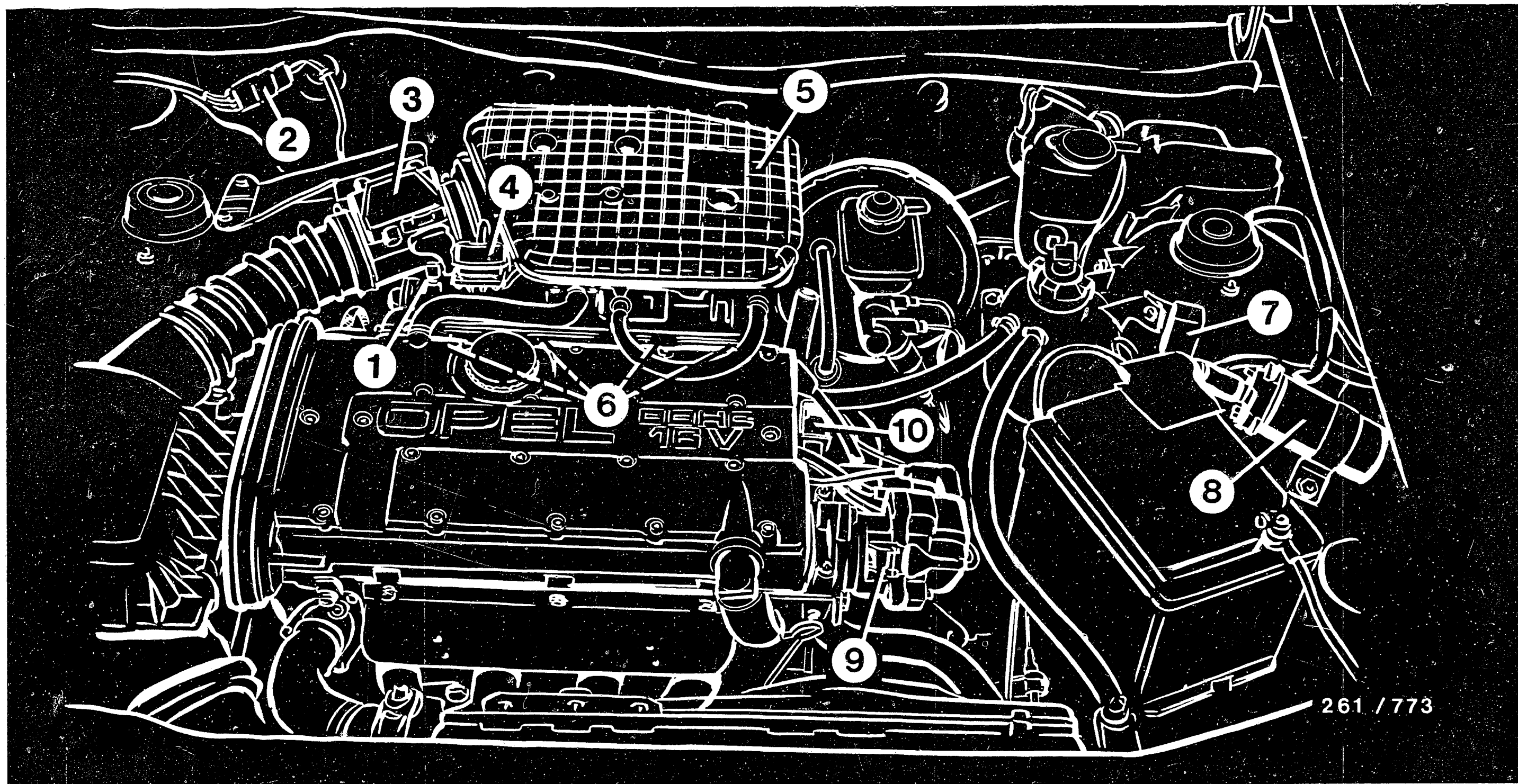
The duration of injection can be
adjusted by max. 0.5 ms with
the potentiometer.

- * Vehicles with catalytic converter:
No provision for measurement,
CO potentiometer without effect.

+) Caution! The basic values given may differ due to
variant coding. Refer to table in "special features"
section.

For settings for valve clearance and other
technical engine data, refer to equipment and
autodata microcard.

For production reasons:
continued on the following
coordinate.



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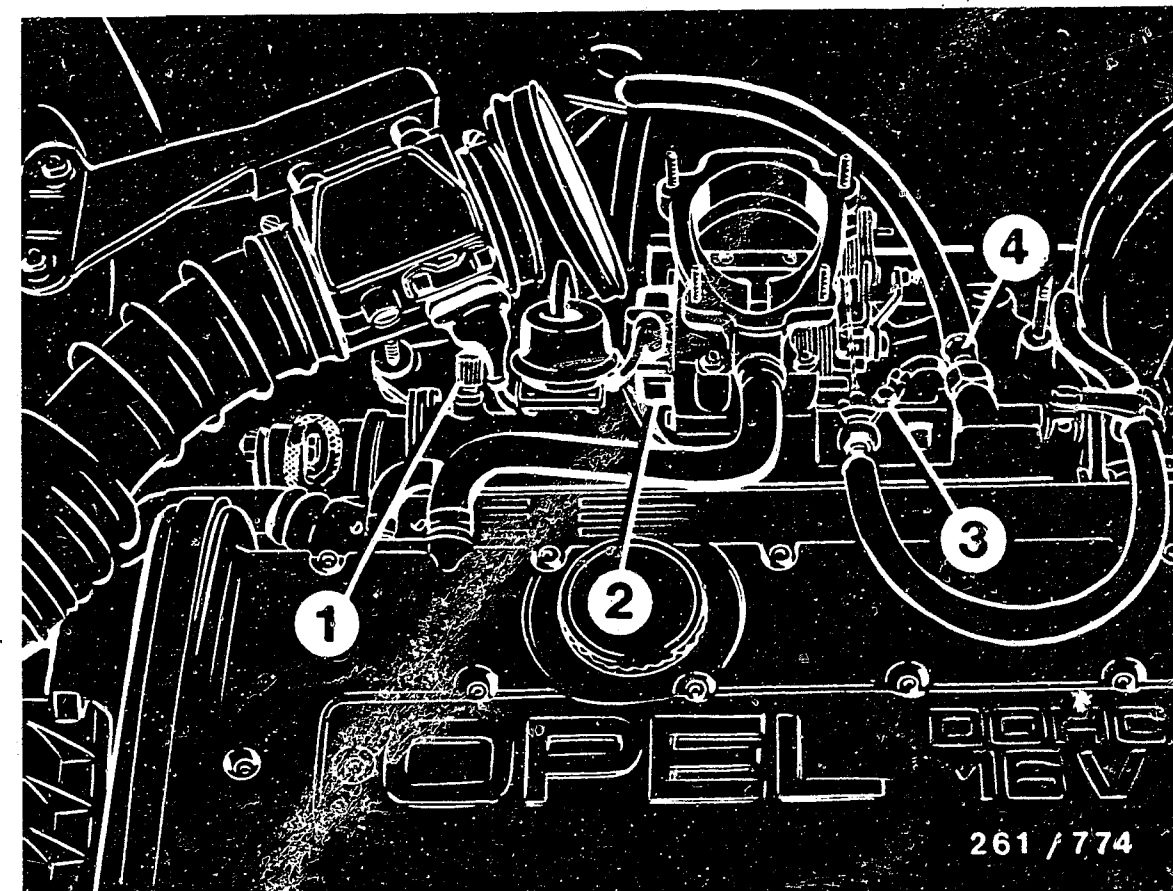
- | | |
|------------------------|---|
| 1 = Ventilation valve | 6 = Injection valves |
| 2 = Lambda-sensor plug | 7 = Motronic relay |
| 3 = Air-mass meter | 8 = Ignition coil with ignition output stage |
| 4 = Pressure regulator | 9 = Ignition distributor with phase sensor (Hall generator) |
| 5 = Air scoop | 10 = Tank-ventilation valve |

INSTALLATION POSITION OF COMPONENTS

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The details of installation positions always refer to the forward direction of travel.

- * Control unit:
In the passenger's footwell on the right. Lift up rubber strip and cover on door sill slightly. Fold away carpet to the side and remove control-unit cover. Unscrew control unit. Unlatch plug, fold up and detach.
- * Temperature sensor (engine):
In engine block, on the right at the front in the coolant circuit.
- * Reference-mark/engine-speed sensor:
On engine block at the front on the right, beneath the fastening flange.
- * Lambda sensor (heated):
In the common exhaust pipe upstream of the catalytic converter at the level of the firewall. Plug connection: in engine compartment on the firewall on the right.
- * Fuses:
In the instrument panel, bottom left.
- * Idle actuator:
Beneath intake manifold.
- * Knock sensor:
On engine block beneath intake manifold, in front of idle actuator.
- * Electric fuel pump and fuel filter:
Between fuel tank and right-hand rear wheel.
- * Tank ventilation valve:
On engine block on the left.
- * Carbon filter:
In wheel house of left-hand front wheel.



- 1 = Ventilation valve
- 2 = Throttle-valve switch
- 3 = Ground terminals
- 4 = High-pressure fuel line

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Installation of pressure gauge:
Remove air scoop. Relieve fuel pressure via ventilation valve. Soak up fuel with cloth. Fit pressure gauge in high-pressure delivery line (M 16x1.5) (Item 4).
Actuate ventilation valve before and after intervention in the fuel system. Pay attention to leakages!
- * Diagnostic plug, coding plug:
In engine compartment on the right near spring-strut housing.
- * Ignition distributor:
When replacing, plug hole to cam shaft or oil will escape. Check O-ring seal on ignition-distributor shaft.

Trouble-shooting instructions : OPE-5011
BOSCH system : Motronic ML 4.1
Make of vehicle : OPEL
Basic microcard : PKW-050

TABLE OF CONTENTS

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Special features	02
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Self-diagnosis test table	09
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Electrical terminal diagram	19
Installation position of components, notes on removal and installation	23

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

OPEL Omega 3000 (-> 2.88) and
OPEL Senator B (-> 2.88)
with 3.0 l / 6-cylinder engine,
engine type CIH, C 30 NE plus with
catalytic converter, 130 kW.

- * Motronic ML 4.1 with self-diagnosis
- * One common sensor for engine speed and reference mark
- * Single-winding rotary actuator
- * Lambda closed-loop control
- * Variant coding for octane-rating adaptation and transmission
- * Vehicles with electronically controlled transmission shift:
During gear shifts, the electronic transmission control advances the spark-advance angle briefly via the Motronic control unit. In this way, the jolt on shifting gear is reduced.
- * Ignition distributor is used only as a high-voltage distributor.
Adjustment required.
- * Air-flow sensor with bypass screw (no CO potentiometer). Adjusting (turning) the bypass screw has no effect, since any adjustment is compensated for by the adaptative Lambda closed-loop control.

Variant coding

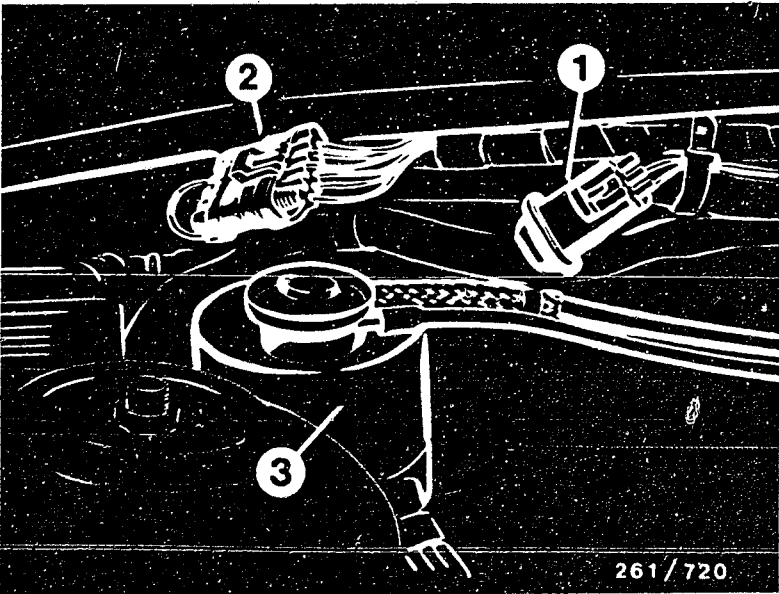
Octane-rating adaptation with encoding plug (black plug).

Octane rating	Resistance at term. 15 for 3 l engine, 130 kW with cat. conv. with closed-loop control
91 RON *)	0 Ω 1) infinity Ω 2) 750 Ω 2)3)4)
95 RON	220 Ω 1) 1200 Ω 3) 2200 Ω 2) 4700 Ω 2)3) —

*) 91 RON = Regular Gasoline, unleaded
(use only in emergency, if 95 RON is not available).

95 RON = Premium gasoline, unleaded

- 1) = Basic value
- 2) = Idle speed is raised by 100 min⁻¹
- 3) = Acceleration enrichment is made richer.
- 4) = Ignition advance amounts to -5.25 ° crankshaft (retarded) throughout the whole characteristic-map range.



- 1 = Octane-rating encoding plug
- 2 = Diagnostic plug
- 3 = Activated-carbon canister

Vehicles with catalytic converter: term. 27 infinity Ω (open)

Vehicles with manually shifted transmission:
term. 10 infinity Ω (open)
term. 28 zero Ω (to ground)

Vehicles with automatic transmission:
term. 10 zero Ω (to ground)
term. 28 to selection-lever position
P and N: zero Ω (via selection lever
to ground). In this way, the idle speed
is reduced in order to avoid driving
off. In all other selection-lever
positions, term. 28 is open (0 Ω)

Vehicles with air conditioner:
term. 29 to switch for defroster lever
(air-conditioner readiness).
term. 32 to switch for compressor.

Vehicles with distance-travelled frequency sensor
(speedo signal):
term. 26 connected to distance-travelled
frequency sensor.
Distance-travelled frequency sensor
is installed only in conjunction with the
on-board computer, LCD instrument
or electronic speedometer.

STRUCTURE AND USAGE

These brief instructions encompass essentially
vehicle-specific special features and test
specifications (set values).

In accordance with the customer complaint,
the trouble-shooting chart leads to different
causes/component faults.
For a detailed description of trouble-shooting,
see the information in the trouble-shooting
chart of the basic instructions.

ATTENTION: Even if reference is made to
basic instructions, the set values, terminal
assignments and special features of these
vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to
avoid damage to the engine, trigger boxes and
control units or to the ignition system,
observe the information in the basic instructions.

CAUTION!
High-performance ignition system with
dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals
may prove fatal (both on the primary and
secondary sides).

Avoid fuel injection while testing the com-
pression!
Disconnect the Motronic relay.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*										Voltage at control unit
*										Sensor
*	*			*	*					Fuel pressure
*	*			*	*					Solenoid-operated injection valves
	*	*								Idle contact
				*						Full-load contact
	*	*	*	*	*	*				Air-flow sensor
	*	*	*							Idle actuator
*	*	*	*							Air-induction system
	*									Idle speed
*	*		*	*						Ignition coil
*	*	*	*	*	*					Primary signal
	*	*	*	*	*					Secondary pattern
*	*	*	*		*	*	*	*	*	Ignition point
	*									Exhaust gas
	*									Overrun cut-off
	*	*	*							Interference-suppression resistors
	*	*	*							Noise test
				*						Interference

TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
				*						Throttle valve
				*						Fuel delivery
	*	*	*							Tank vent
		*	*							Lambda closed-loop control
*	*	*	*	*	*	*	*	*	*	Motronic control unit
			*	*						Electronic transmission control

SELF-DIAGNOSIS TEST TABLE

Fault indication Flash code	Testing of components/function	Test instructions/Test conditions	Terminals	Set values
1 2	Control unit/flashing-code output OK	Flashing-code output does not operate if fault lamp, supply leads to fault lamp and to diagnostic plug, and the current supply to the control unit are defective. If everything is O.K., but no flashing code is output, the control unit is defective.	4, 17	—
1 3	Lambda sensor/voltage change	Break in lead to lambda sensor	24	—
1 4	Temperature sensor (engine)/short circuit to ground	Test temperature sensor and lead for short circuit to ground.	13	—
1 5	Temperature sensor (engine)/open circuit	Test temperature sensor and leads for open circuit. Temperature-sensor resistance : at +15...+30°C ; at approx. +80°C ;	13, ground	1450...3300 Ω 280...360 Ω
4 4	Lambda sensor/short circuit to ground	Test lead for short circuit to ground. Watch out for rubbed locations!	24	—
4 5	Lambda sensor/short circuit to battery voltage	Test lead for short circuit to battery voltage. Watch out for rubbed locations!	24	—
4 8	Supply voltage for control unit too low (with engine running)	Supply voltage: Test voltage drops at positive and ground terminals. Charge battery.	35(+), 5(-)	greater than 10 V
4 9	Supply voltage for control unit too high (with engine running)	Supply voltage: Test generator regulator.	35(+), 5(-)	less than 16 V

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Term- inals	Set values
5 1	Control unit/digital section	Control unit defective	—	—
6 7	Throttle-valve switch/ idle contact	Fault: idle contact permanently closed. Idle contact closed in rest position: Slightly activate throttle valve:	2, ground	0 Ω infinity Ω
6 9	Temperature sensor (air)/short circuit to ground	Test temperature sensor and lead for short circuit to ground.	22	—
7 1	Temperature sensor (air)/open circuit	Test temperature sensor and leads for open circuit and short circuit to battery voltage. Temperature-sensor resistance: at +15°C...+30°C:	22.6(-)	1450...3300 Ω
7 2	Throttle-valve switch/ full-load contact	Fault: full-load contact permanently closed. Fault lamp lights up only intermittently in overrun. Full-load contact closed in full-throttle position: Slightly release accelerator pedal:	3	0 Ω infinity Ω

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
7 3	Air-flow sensor/ short circuit to ground	Test lead from term. 7 for short circuit to ground. Test leads from term. 7 and term. 9 for open circuit. Test leads from term. 6 and term. 9 for contact with each other. Sticking air-flow sensor flap in the air-flow sensor, e.g. due to icing up or mechanical defect in air-flow sensor.	6(-), 7, 9(+)	—
7 4	Air-flow sensor/load signal too strong	Test lead from term. 6 for open circuit. Test leads from term. 6 and term. 7 for short circuit to positive (5V or battery positive). Test resistances of air-flow sensor: between term. 6 and term. 7 (deflect air-flow sensor flap): between term. 6 and term. 9: Air-flow sensor defective.	6(-), 7	8...2500 Ω 500...1100 Ω
7 5	Engine action (intervention) by electronic transmission control. Short circuit to ground	Test lead for short circuit to ground. Continue testing with electronic transmission control.	8	—

TEST SPECIFICATIONS

<hr/>	
Pressure regulator	
* Fuel pressure	2,8...3,2 bar

<hr/>	
Electric fuel pump	
* Fuel delivery	
(measured in return)	at least 850 cm ³ /30s
Supply voltage	
(under load):	at least 12 V

<hr/>	
Temperature sensor (air)	
* Internal electrical resistance	
measured at air-flow sensor	
between term. 4 and term. 1	
at ambient temperature	
(+15°C...+30°C):	1450...3300 Ω

<hr/>	
Temperature sensor (engine),	
blue plug.	
* Internal electrical resistance	
at ambient temperature	
(+ 15° C...+ 30° C):	1450...3300 Ω
with engine at normal operating temperature	
(approx. + 80° C):	280....360 Ω

<hr/>	
Solenoid-operated injection valve	
* Internal electrical resistance	
at ambient temperature	
(+ 15° C...+ 30° C):	14,5...17,5 Ω

<hr/>	
Air-flow sensor	
* Internal electrical resistance between:	
term. 2 and term. 4 :	8...2500 Ω (1)
term. 3 and term. 4 :	500...1100 Ω

(1) Deflect air-flow sensor flap slowly as far as it will go.
Resistance fluctuates between the terminals of the potentiometer.

TEST SPECIFICATIONS (CONTINUED)

<hr/>	
Engine-speed sensor and reference-mark sensor	
* Internal electrical resistance	
at ambient temperature	
(+15°C...+30°C):	400...800 Ω
* Air gap:	0,8 ± 0,5 mm

<hr/>	
Throttle-valve switch	
* Resistance value of idle contact	
(term. 2 and term. 18):	approx. 0 Ω
* Resistance value of full-load	
contact (term. 3 and term. 18)	approx. 0 Ω

<hr/>	
Thottle-valve switch with potentiometer	
* Resistance value of idle	
contact (term. 6 and term. 4):	approx. 0 Ω
* Resistance value of full-load	
contact (term. 5 and term. 4):	approx. 0 Ω
* For test of potentiometer, see	
microcard for transmission control.	

<hr/>	
Idle actuator	
* Internal electrical resistance	
at +15°...+30°C :	approx. 8 Ω

<hr/>	
Lambda sensor	
* Resistance value of heater winding:	1...15 Ω

<hr/>	
Ignition coil	
* Primary resistor	approx. 0 Ω
* Secondary resistor	5000...7200 Ω

<hr/>	
Interference-suppression resistors	
* High-voltage-distributor rotor:	1 k Ω
The secondary side of the ignition system must be interference-suppressed with at least 5 k Ω total resistance. High-voltage resistance cables are installed as standard.	

TEST SPECIFICATIONS (CONTINUED)

Idle test:

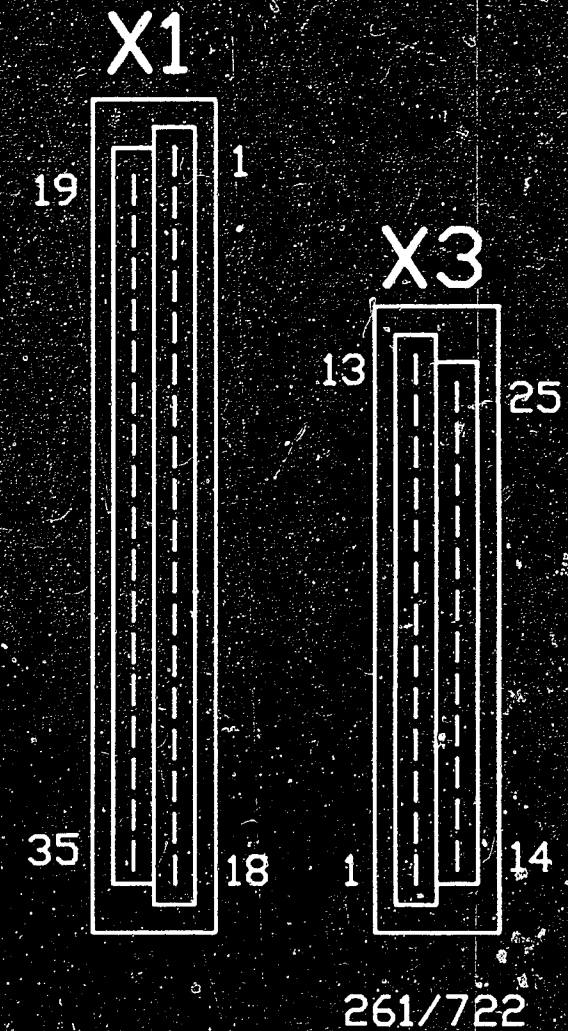
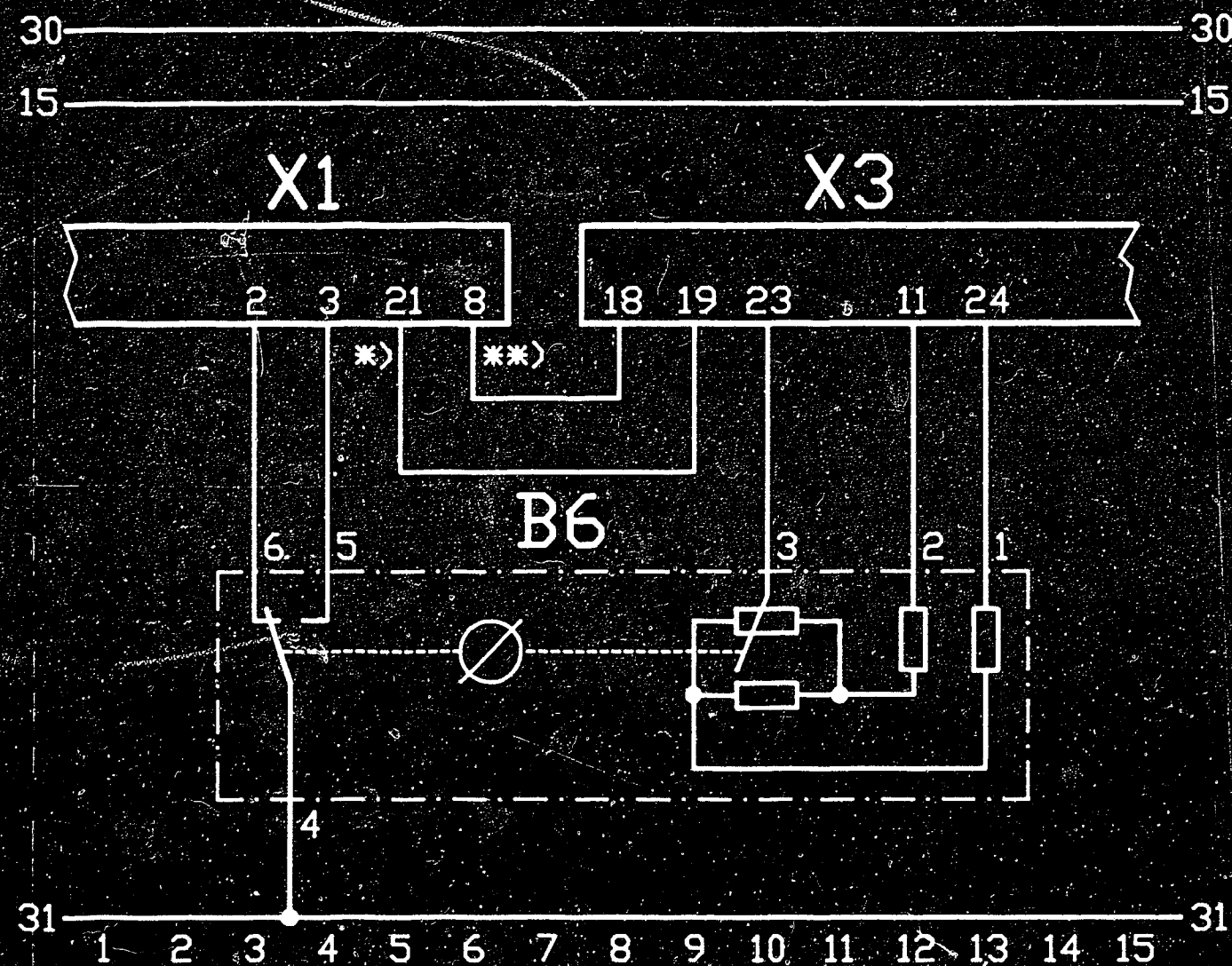
- Engine at normal
operating temperature,
switch off loads.
- * Idle speed: 700 \pm 40 min ⁻¹ +)
 - * Spark-advance angle: 10 \pm 5 ° crankshaft +)

Automatic transmission to N or P

+) Attention! The basic values stated may deviate due
to variant encoding. Pay attention to table in
"Special Features" section.

See equipment and Autodata microcards for
settings for valve clearance and other engine-
related data.

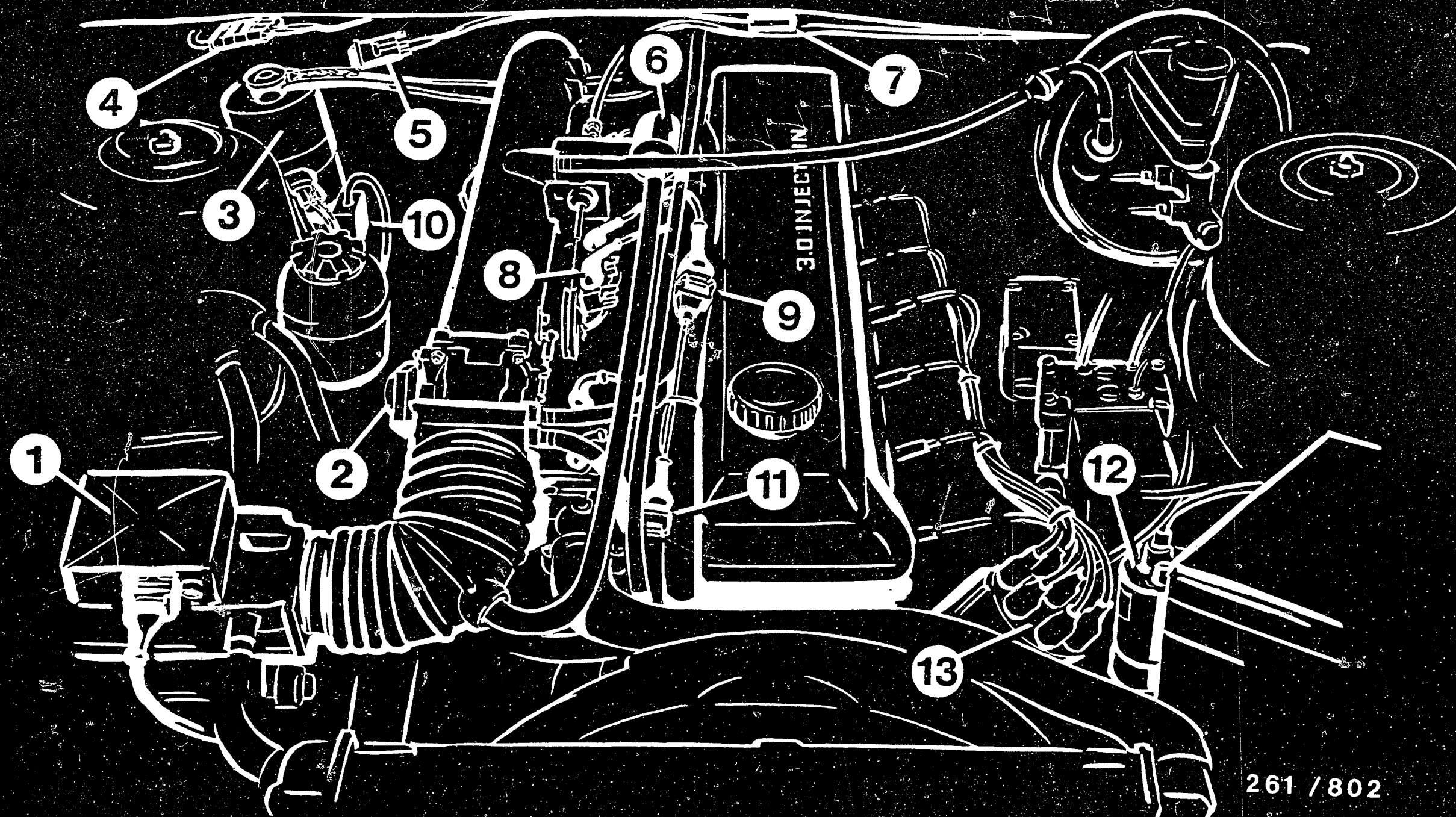
For production reasons:
continued on the following
coordinate.



B6 = Throttle-valve switch
with potentiometer for
electronic transmission
control
X1 = Motronic control-unit plug
X3 = Transmission control-unit plug

*.) = Output for engine speed
**.) = Input for engine action

ELECTRICAL TERMINAL DIAGRAM (CONTINUED)
(Deviations for vehicles with electronic transmission control)

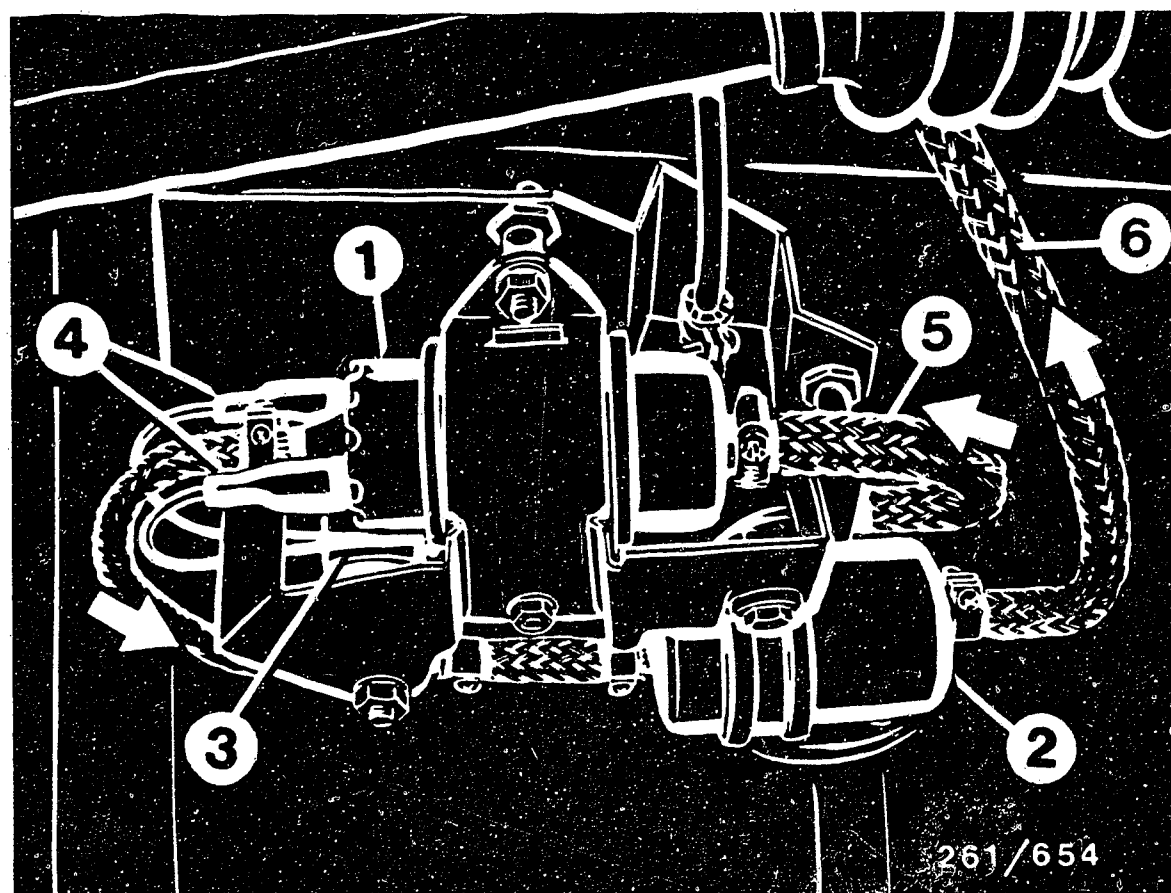


261 / 802

- 1 = Air-flow sensor
- 2 = Throttle-valve switch
- 3 = Activated-carbon canister
- 4 = Diagnostic plug
- 5 = Octane-rating encoding plug
- 6 = Rotary actuator

- 7 = Lambda-sensor plug-in connection
- 8 = Injection valves
- 9 = Engine-speed-sensor plug-in connection
- 10 = Tank-ventilation valve
- 11 = Temperature sensor (engine)
- 12 = Ignition coil
- 13 = High-voltage distributor

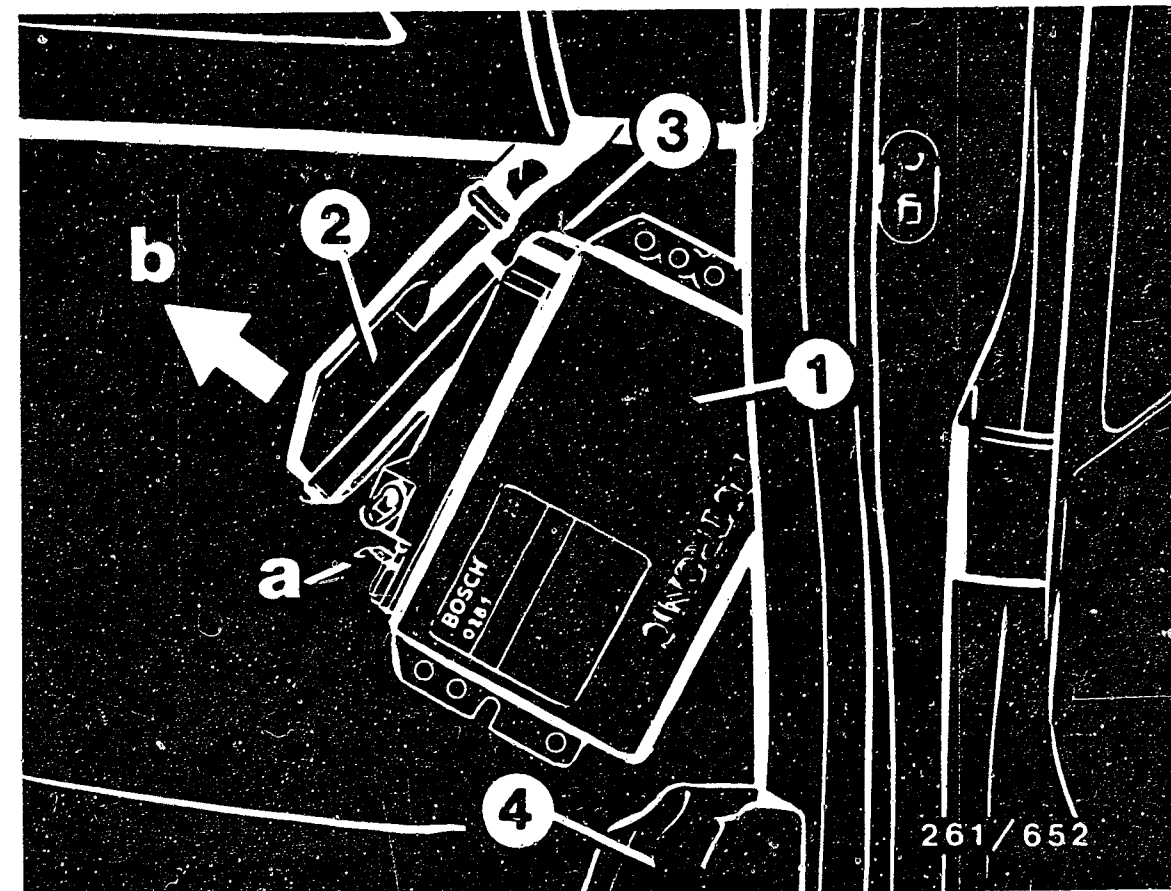
INSTALLATION POSITION OF COMPONENTS



- 1 = Electric fuel pump
- 2 = Fuel filter
- 3 = Pressure damper
- 4 = Electrical connections

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Electric fuel pump and fuel filter:
In front of the fuel tank.
- * Ground terminal:
In engine compartment at front on left-hand side on the bodywork next to the battery.
- * Diagnostic plug:
In engine compartment on right-hand side on the firewall.
- * Octane-rating encoding plug:
In engine compartment on right-hand side of the firewall.

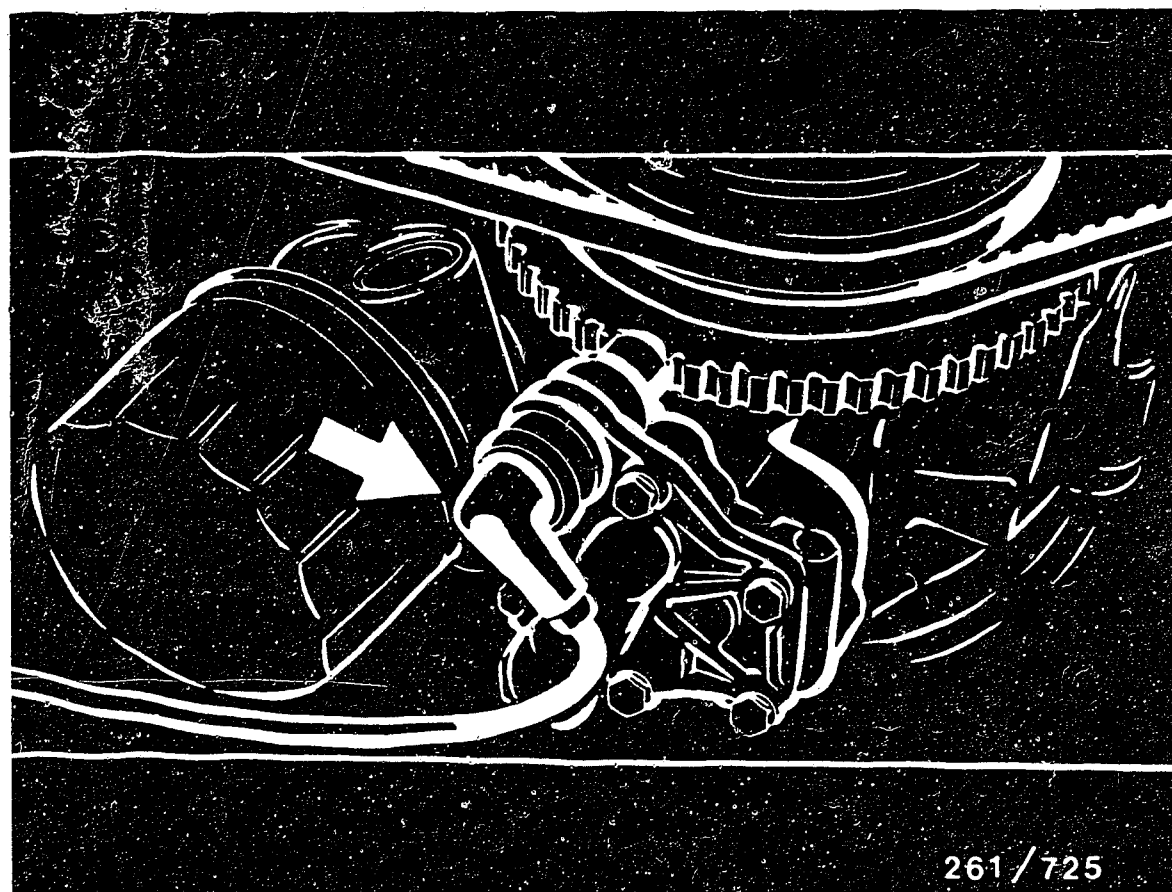


- 1 = Control unit
- 2 = Plug
- 3 = Mechanical encoding with lug
- 4 = Covering over door sill

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The indications "right" and "left" always refer to the forward direction of travel.

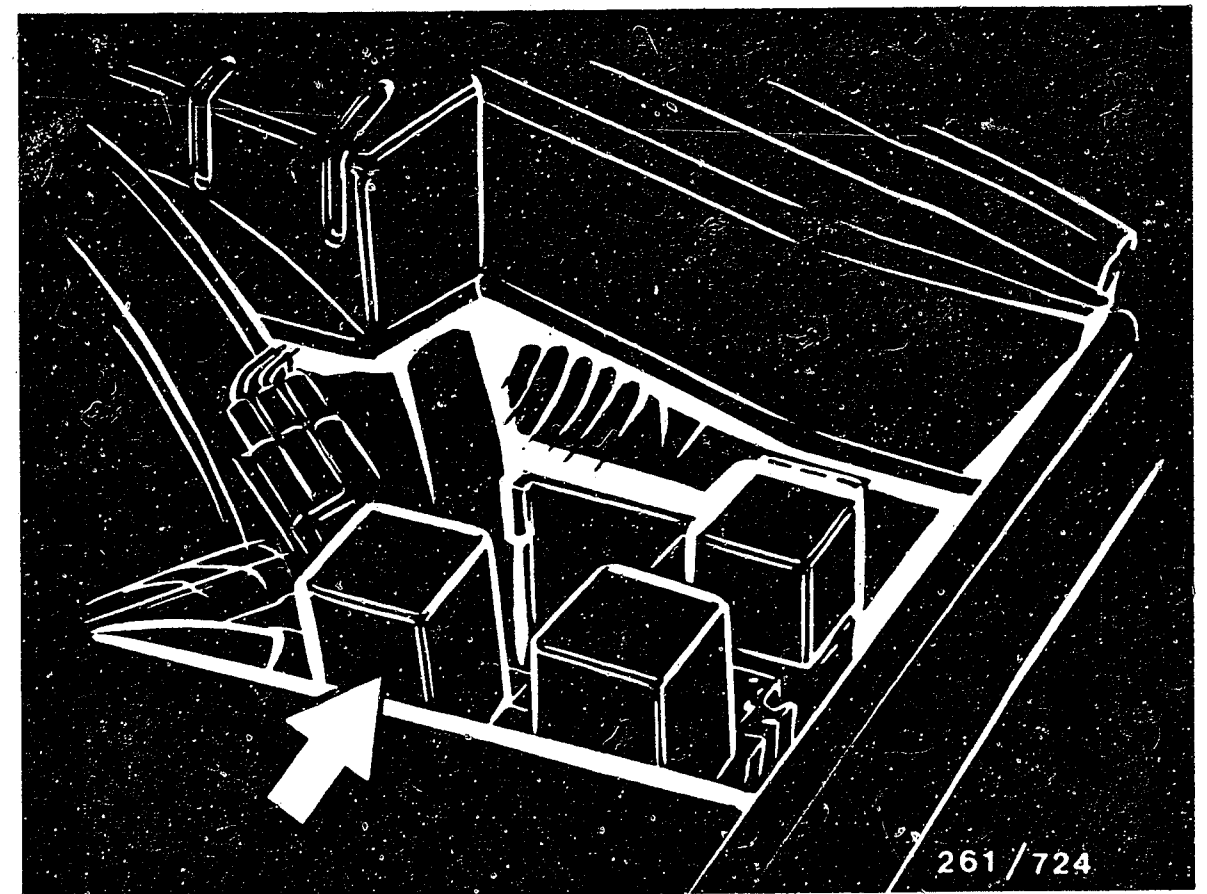
- * Control unit:
In passenger-side footwell on the right. Slightly lift up rubber strip and cover on door sill. Lift up floor carpet to one side and remove control-unit cover. Unscrew control unit. Unlatch plug (a), fold back (arrow b) and unhook (Item 3).
- * Temperature sensor (engine):
On engine block at the front on the right, blue plug.



Arrow = Reference-mark / engine-speed sensor

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Reference-mark/engine-speed sensor:
On oil-pump housing next to oil filter
(accessible from below).
- * Lambda sensor:
In common exhaust pipe upstream of the
catalytic converters.
- * Fuses:
In instrument panel, bottom left.
Fuse box can be tilted open at its
underside.
- * Temperature sensor (air):
In air-flow sensor



Arrow = Motronic relay

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Motronic relay:
In engine compartment on left-hand side in front of the
firewall.
- * Adjust ignition distributor:
Remove cap and protective cover from ignition
distributor.
Position cylinder 1 to ignition-timing
mark (pointer in inspection hole on cylinder
block points to ball in flywheel).
Center of ignition-distributor rotor must
point to marking on housing of cylinder 1.
If necessary, turn ignition-distributor housing;
to do this, loosen clamping strap.
- * Distance-travel frequency sensor:
At transmission output beneath vehicle.

Trouble-shooting instructions : PEU-5008
BOSCH system : Motronic ML 4.1
Make of vehicle : PEUGEOT
Basic microcard : PKW-050

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Trouble-shooting chart	07
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Installation position of components, notes on removal and installation	19

SPECIAL FEATURES

These trouble-shooting instructions apply to the following vehicle models valid at the time of writing:

PEUGEOT 405 M1 16 and
CITROEN BX 19 GTi 16V
with 1.9 l / 4 cyl./16-valve engine 107 kW
Engine type: XU 9 J 4. both as of 9.87

- * Motronic ML 4.1 with self-diagnosis.
- * One sensor for engine speed and reference mark.
- * Single-winding rotary actuator.
- * External ignition output stage (trigger box).
- * In this vehicle, the self-diagnosis additionally contains a so-called actuator diagnosis feature and system adaptation for the idle-speed control (ISC conditional adaptation).

Actuator diagnosis makes it possible to actively test the outputs of the Motronic control unit and the components connected to the control unit, including the connecting leads. In these vehicles, the following components are activated by the actuator diagnosis:

1. Injection valves
2. Idle actuator

With the aid of the ISC conditional adaptation (ISC = idle-speed control), it is possible to adapt the control unit rapidly to the operating state of the engine, e.g. poor idling, following the elimination of leakages in the input system, detachment of the battery or the control unit (test drive is unnecessary). This function should also be stimulated if, for example, there is a complaint of the idle speed being undercut following overrun operation.

SPECIAL FEATURES (continued)

How to use the self-diagnosis:

The self-diagnosis, actuator diagnosis and ISC conditional adaptation are activated and evaluated with the evaluating unit KDAW 9980 (in the Peugeot, a test lamp is fitted in the instrument panel; see "Installation position of components").

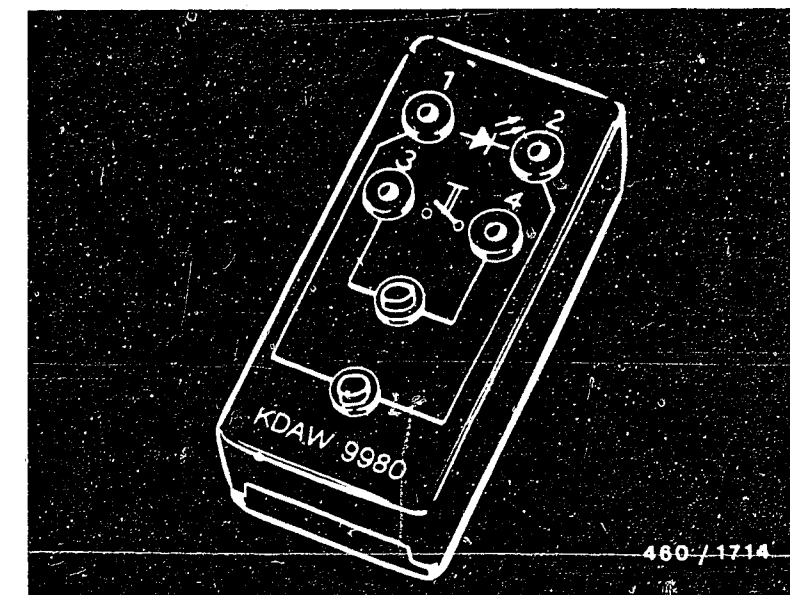
Connect evaluating unit KDAW 9980:

Connect tracer from evaluating unit (sockets 3 and 4) between diagnosis test coupling term. 1 and vehicle ground (see lower illustration).

If the test lamp is not fitted in the vehicle, use the test lamp on the evaluating unit. To do this, socket 2 of the evaluating unit must be connected to diagnosis test coupling term. 2 and socket 1 of the evaluating unit to battery positive.

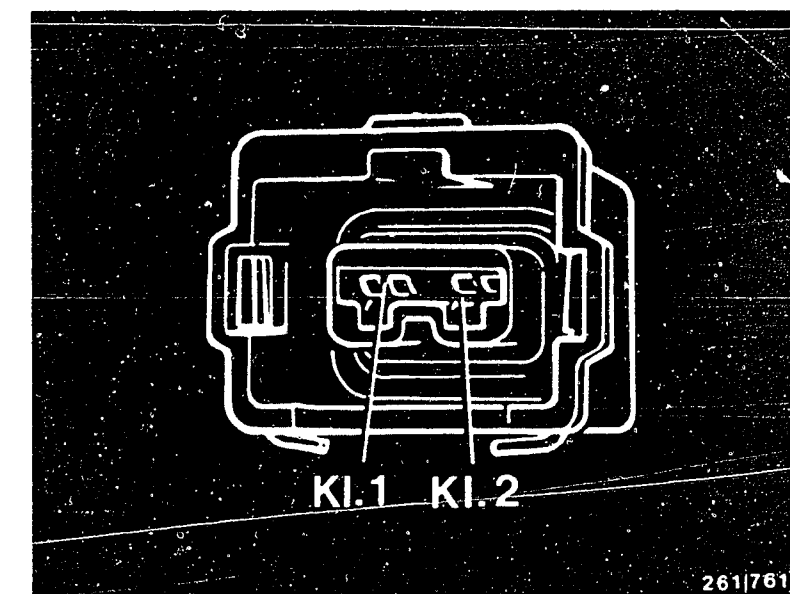
Activating the self-diagnosis (fault output):

- Switch on ignition (fault lamp lights up)
- Stimulate for between 2.5 and 5 seconds (press button)
- Fault output always begins with "1 2"
- Stimulate again for between 2.5 and 5 seconds in order to read out the first fault (if present) etc.
- "1 1" appears as the message "end of output" when all stored faults have been output or after "1 2" if the fault memory is empty.
- Switching off the ignition overrides the system to terminate self-diagnosis.



Evaluating unit KDAW 9980

Diagnosis test coupling
(as for injection-valve plug)



SPECIAL FEATURES (continued)

Activating the actuator diagnosis:

- First stimulation process (flashing code 1 4 1 1):
Begin stimulation before switching on the ignition.
During stimulation, switch on ignition and stop stimulation after 2.5 to 5 seconds.
When the fault lamp signals "1 4 1 1", this means that actuator diagnosis for the injection valves has been activated.
The injection valves should then audibly pulse, otherwise there is an open circuit in the common lead to control unit term. 14 or the output stage in the control unit is faulty.
In order to test the injection valves individually, each of the three other valve plugs must be detached.

Caution! If there is residual fuel pressure in the system, fuel is injected into the cylinders so this step should be activated for as short a time as possible.

- Second stimulation process (flashing code 1 4 1 2):
Actuator diagnosis of the idle actuator.
Rotary slider of the idle actuator is activated periodically (clearly audible).
- Third stimulation process (flashing code 1 4 1 4):
Actuator diagnosis of the tank-ventilation valve (not applicable since no tank-ventilation valve is fitted; the associated flashing code "1 4 1 4" is output, however).
- Fourth stimulation process (flashing code 1 1):
Actuator diagnosis completed.

Activation of the ISC conditional adaptation:

- Boundary conditions: Idle contact closed, engine at operating temperature, electrical loads switched off
- Stimulate first, during stimulation switch on ignition and start engine
- After running at idle for between 2.5 and 5 seconds, stop stimulation process (conditional adaptation is activated)
- After a few seconds and when the engine idle is steady, repeat stimulation process to terminate conditional adaptation.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION! Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

- * Avoid injection of fuel and high-voltage flashovers when testing the compression.
Therefore, disconnect main relay.

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

										Cause (component fault)
*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*										Voltage at control unit
*										Sensor
*		*			*	*				Fuel pressure
*		*				*	*			Solenoid-operated injection valves
		*	*							Idle contact
					*					Full-load contact
	*	*	*	*	*	*				Air-flow sensor
	*	*	*	*						Idle actuator
*	*	*	*							Air-induction system
		*								Idle speed
*		*		*	*					Ignition coil
*		*	*	*	*					Primary signal
		*	*	*	*	*				Secondary pattern
*	*	*	*		*	*		*	*	Ignition point
		*								Exhaust gas
		*								Overrun cut-off
		*	*	*						Interference-suppression resistors
		*	*	*						Noise test
					*					Interference

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

										Cause (component fault)
	*	*	*							Noise test
				*						Fuel delivery quantity
	*			*						Throttle valve
*				*						Voltage at trigger box
*				*						Activation of trigger box
*	*	*	*	*	*	*		*	*	Control unit

SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Inspection of component/function	Test instructions/Test conditions	Terminals	Set values
1 2	Control unit/flashing-code output functioning correctly (start of output)	Flashing-code output not functioning if fault lamp, leads to fault lamp and to diagnostics plug or power supply to the control unit are defective. If all these are O.K., but no flashing code is output, control unit defective.	4, 17	—
1 3	Temperature sensor (intake air)	Check temperature sensor and lead for short circuit to ground and open circuit. Resistance of temperature sensor: at +15°C...+30°C:	22	— 1450...3300 Ω
1 4	Temperature sensor (engine)	Test temperature-sensor lead for short circuit to ground and open circuit. Resistance of temperature sensor: at +15... +30°C : at approx. +80°C :	13	— 1450...3300 Ω 280... 360 Ω
1 5	Fuel-pump relay	Fault: Short circuit to ground, to battery voltage or open circuit. Resistance of relay winding (term. 85/86):	20	50... 150 Ω
2 1	Throttle-valve switch/ Idle contact	Fault: Idle contact constantly closed. Idle contact closed in off-position: Deflect throttle valve slightly:	2	Approx. 0 Ω infinity Ω
2 2	Idle actuator	Fault: Actuator winding or supply lead has short circuit to ground, to batt. voltage or open circuit. Resistance of actuator winding:	33	Approx. 8 Ω

SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Flashing code	Inspection of component/function	Test instructions/Test conditions	Terminals	Set values
3 3	Air-flow sensor	Check air-flow-sensor supply leads for continuity, short circuit to ground, to battery voltage and between each other. Measure resistances of air-flow sensor between term. 7 and term. 6 (change in resistance as air-flow sensor flap is deflected): Between term. 9 and term. 6:	9, 7, 6	8...2500 Ω 300...550 Ω
3 5	Throttle-valve switch/ full-load contact	Fault: Full-load contact constantly closed. Fault lamp (if fitted) may light up occasionally in overrun operation. Full-load contact closed in full-throttle position: Release pressure on accelerator pedal slightly:	3	Approx. 0 Ω infinity Ω
5 3	Supply voltage for control unit too low or too high (with engine running)	Supply voltage: Check voltage drops at positive and ground terminals. Charge battery, check generator system.	35(+), 5(-)	10...16 V
5 4	Control unit/digital section	Control unit defective.	—	—
5 5	Potentiometer for CO adjustment/ voltage too low or too high	Measure resistance of potentiometer. Check leads for short circuit to ground, battery voltage or open circuit. Voltage between pin 1 and 4 (ground) of air-flow sensor must be between 0.1 and 4.9 V (switch on ignition or leave engine running). Note: Watch for worn insulation on leads. Air-flow-sensor supply leads must have no electrical contact with each other.	30	Measure resistance at air-flow sensor between term. 1 and term. 4: Minimum: 0...30 Ω Maximum: The value measured between term. 3 and term. 4 may be upto 30 Ω lower. (Set value between term. 3 and term. 4: 300...550 Ω)
1 1	End of output			

TEST SPECIFICATIONS

* Pressure regulator

Fuel pressure: 2,8...3,2 bar

* Electric fuel pump

Fuel delivery
(measured in return): min. 800 cm³ /30s
Supply voltage
(under load): min. 12 V

* Temperature sensor (intake air)

Electrical internal resistance
measured at air-flow sensor
between term. 5 and term. 4
at ambient temperature
(+15°C...+30°C): 1450...3300 Ω

* Temperature sensor (engine) (Plug color blue)

Electrical internal resistance
at ambient temperature
(+ 15° C...+ 30° C): 1450...3300 Ω
engine at operating temperature
(approx. + 80° C): 280... 360 Ω

* Air-flow sensor

Electrical internal resistance at
term. 2 and term. 4 : 8...2500 Ω (1)
term. 3 and term. 4 : 300... 550 Ω

Term. 1 and term. 4
(CO potentiometer)

Minimum : 0... 30 Ω
Maximum : The actual value measured at term. 3
and term. 4 may be up to 30 Ω lower.

(1) Slowly deflect air-flow sensor plate to the stop.
Resistance fluctuates between the end points of the
potentiometer.

TEST SPECIFICATIONS (continued)

* Engine-speed/ reference-mark sensor

Electrical internal resistance
at ambient temperature
(+15°C...+30°C): 400...800 Ω
Air gap: 0,8 ±0,5 mm

* Throttle-valve switch

Resistance value of idle contact
(term. 1 and term. 2): Approx. 0 Ω

Resistance value of full-load
contact (term. 1 and term. 3): Approx. 0 Ω

* Trigger box (output stage)

Supply voltage at
term. 15...17,5 and term. 4 : 2 V,
(with engine at idle): max. 1 V less than
battery voltage

Supply voltage at
term. 12...14 and term. 4 : Battery voltage
(with ignition ON)

Control signal at
term. 2 and term. 5 : Rectangular pulses

* Idle actuator

Electrical internal resistance
at +15°...+30°C : Approx. 2 Ω

* Ignition coil

Primary resistance: 8 Ω
Secondary resistance: 0,5... 0,9 k Ω

TEST SPECIFICATIONS (continued)

* Idle test

Engine at operating temperature,
switch off loads.

Idle speed: 850 \pm 50 min $^{-1}$

Spark-advance angle: 7 \pm 5 $^{\circ}$ crankshaft

Note:

If TDC sensor is fitted (3-pin connector), use diagnosis
lead 1 684 465 188 for measuring the spark-advance
angle.

* CO content: 1,0 \pm 0,5 % CO by vol.

Adjust mixture with CO potentiometer
in air-flow sensor:

Turning counter-clockwise gives a leaner mixture,
turning clockwise gives a richer mixture.

The duration of injection can be adjusted by
max. approx. 0.5 ms with the potentiometer.

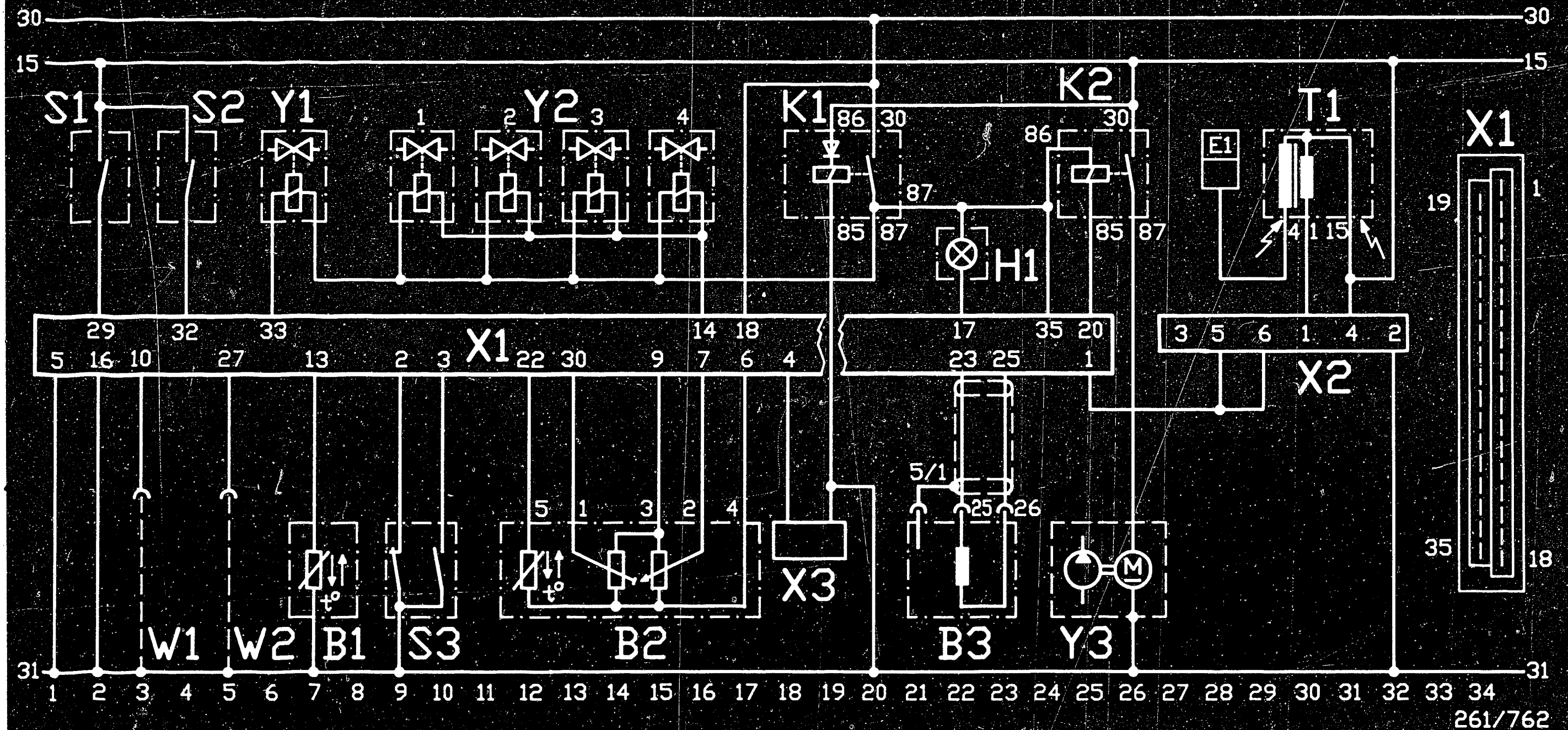
Interference-suppression resistors

High-voltage-distributor rotor: 1 k Ω

The secondary side of the ignition system must have
at least 5 k Ω total resistance interference
suppression. High-voltage resistance cables are fitted
as standard.

For valve-clearance setting and other technical
engine data, refer to the equipment and autodata
microcard.

For production reasons:
continued on the following
coordinate.



B1= Temperature sensor (engine)
 B2= Air-flow sensor with CO potentiometer
 B3= Engine-speed/reference-mark sensor
 E1= High-voltage distributor
 H1= Fault lamp
 K1= Main relay
 K2= Pump relay

S1= Air-conditioning ready switch
 (if fitted)
 S2= Air-conditioning compressor switch
 (if fitted)
 S3= Throttle-valve switch
 T1= Ignition coil
 W1= Coding for ignition map
 (98/95 RON)

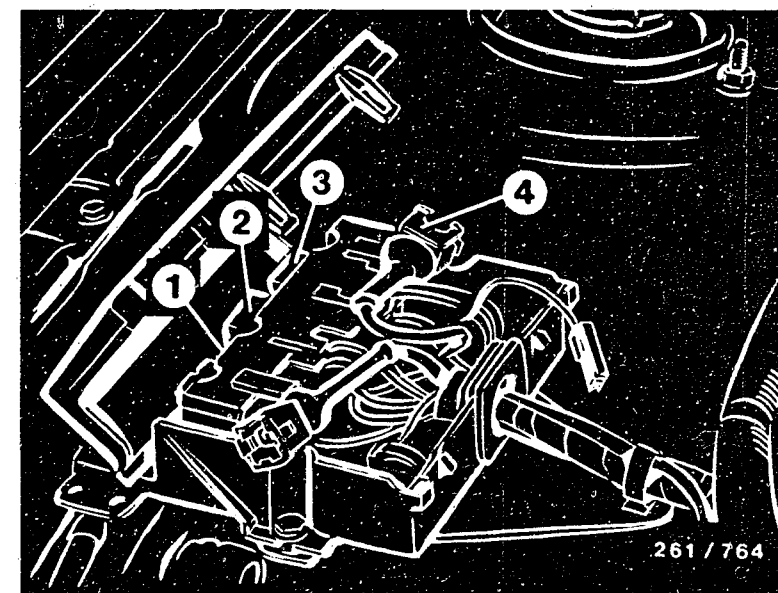
W2= Coding for national
 variant (with/without lambda)
 X1= Control-unit plug
 (35-pin)
 X2= Ignition trigger-box plug
 X3= Diagnosis test coupling
 Y1= Idle actuator (single-winding)
 Y2= Solenoid-operated injection valves
 Y3= Electric fuel pump

ELECTRICAL TERMINAL DIAGRAM

INSTALLATION POSITION OF COMPONENTS (continued)

The details of installation positions always refer to the forward direction of travel.

- * Diagnosis test coupling (black):
2-pin plug (like injection-valve plug) in black plastic box near right-hand spring-strut housing.
Stimulation lead (control unit term. 4) on the left when the plug is looked at from the front.
- * Fuse for electric fuel pump, main relay and pump relay:
In black plastic box on right-hand spring-strut housing.
- * Electric fuel pump and fuel filter:
Beneath the vehicle between fuel tank and rear axle.
- * Fault lamp (engine control lamp):
In the instrument panel on the left next to the fuel gauge (Peugeot).
- * Fuse box (Peugeot):
In the instrument panel, at the bottom left.
The top of the fuse box can be folded out.
- * Temperature sensor (intake air):
In air-flow sensor.



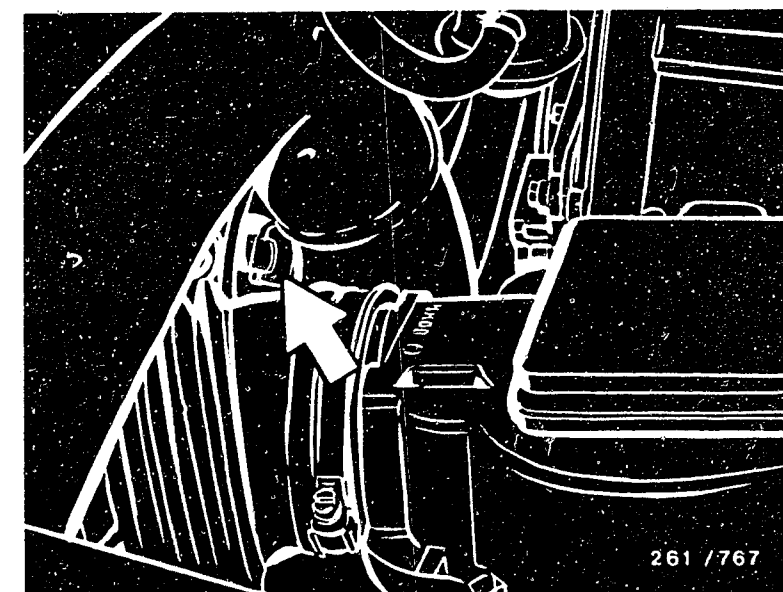
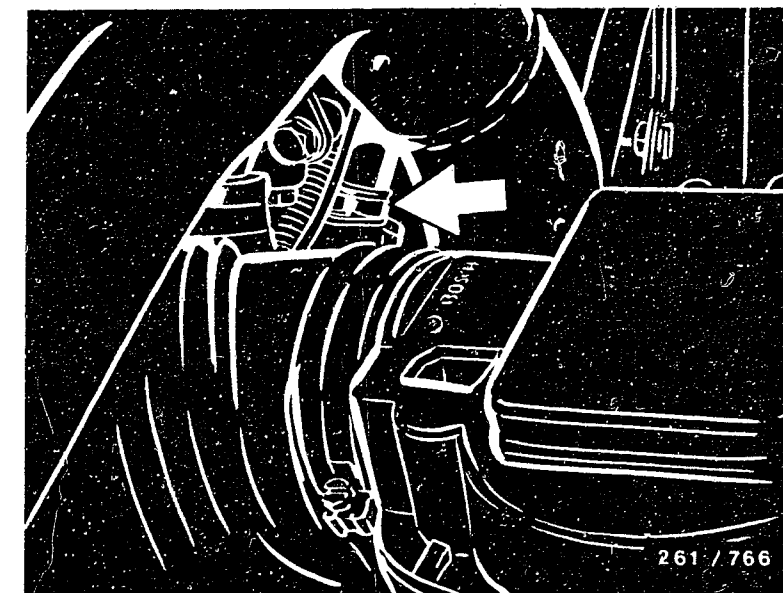
- 1 = Pump fuse
- 2 = Main relay
- 3 = Pump relay
- 4 = Diagnosis test coupling

Arrow = Fault lamp in the Peugeot



INSTALLATION POSITION OF COMPONENTS (continued)

- * Engine-speed/reference-mark sensor:
In the engine block on the left, beneath the high-voltage distributor (upper illustration, arrow).
- * Temperature sensor (engine)
Screwed into engine block, beneath the high-voltage distributor (center illustration, arrow).
- * Throttle-valve switch:
To the side of the throttle-valve assembly (lower illustration, arrow).



Trouble-shooting instructions : POR-5006
BOSCH system : Motronic
Make of vehicle : PORSCHE
Basic microcard : PKW-100

TABLE OF CONTENTS

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SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

PORSCHE 944 S (9.86 ->)
with 2.5 l / 4-cyl. engine, 16 valve

- * Motronic system M 2.1 with self-diagnosis, final-controlling-element diagnosis, switching-signal diagnosis and flashing-code output (55-pole connector).
- * Control unit with variant coding by way of wiring-harness plug (see information given in basic instructions).
- * A joint sensor for engine speed and reference mark.
- * Cylinder-specific knock control with two knock sensors.
- * Magnetic pulse generator (Hall generator) for cylinder recognition and switching of knock sensors.
- * Adaptive lambda closed-loop control (in the case of vehicles with catalytic converter).
- * Tank ventilation with clocked valve.
- * Injection valves with copper coils; therefore series resistors in positive lead of injection valves.
- * TI trigger box as external ignition output stage.
- * The vehicle can be fitted at the factory with an alarm system.
If no alarm system is fitted, there is a jumper in the central-electrics console.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Avoid injection of fuel and high-voltage flashovers when testing the compression.
Therefore, disconnect main relay.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

											Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis
*	*	*	*	*	*	*	*	*	*	*	Final-controlling-element diag.
*											Voltage at control unit
*											Engine-speed/reference-mark sensor
*		*			*	*					Fuel pressure
					*						Fuel delivery
		*	*	*	*	*					Air-flow sensor
*	*	*	*								Air intake system
*		*	*	*	*						Trigger box
*		*		*	*						Ignition coil
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*		*	*		Ignition point
		*									Idle speed, CO
		*									Overrun cut-off
		*	*	*							Interference-suppression resistors
		*	*	*							Noise test
					*						Interference
					*				*		Throttle valve
		*	*				*				Tank ventilation
		*	*								Lambda closed-loop control
*	*	*	*	*	*	*		*	*	*	Control unit

SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
1 1 2 3 1 2 2 3	Lambda closed-loop control on rich or lean stop (Cat vehicles only)	Check CO content, fuel pressure and tank ventilation valve. Check intake system for freedom from leaks. Subject air-flow sensor and tank ventilation valve to electrical and mechanical testing. Fault may also be displayed if tank has been run empty.		
1 1 2 4 1 2 2 4	Lambda sensor (Cat vehicles only)	Open-circuit in lead to lambda sensor or short-circuit to ground or battery voltage. Watch out for worn cable insulation! Sensor heater defective. Sensor clogged.	28	
1 1 2 5 1 2 2 5	Temperature sensor (intake air)	Check temperature sensor and lead for open-circuit and short-circuit to ground. Temperature-sensor resistance at +15...+30°C :	44 1 4	 1450...3300 Ω
1 1 3 1 1 2 3 1	Knock sensor 1	Check leads to knock sensor 1 for open-circuit and mutual contact. Visually inspect knock-sensor plug (mechanical damage, oxidation). Watch out for worn cable insulation! Check tightening torque at knock sensor.	11 30 —	 15...25 Nm
1 1 3 2 1 2 3 2	Knock sensor 2	Check leads to knock sensor 2 for open-circuit and mutual contact. Visually inspect knock-sensor plug (mechanical damage, oxidation). Watch out for worn cable insulation! Check tightening torque at knock sensor.	29 30 —	 15...25 Nm
1 1 3 3 1 2 3 3	Knock detection	Control unit defective		

SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/test conditions	Terminals	Set values
1 1 3 4 1 2 3 4	Magnetic pulse generator (Hall generator)	Check voltage and control leads of magnetic pulse generator for open-circuit. Check voltage supply at magnetic-pulse-generator plug, term. 1(+) and term. 3(-). Function: signal at magnetic-pulse-generator plug (oscilloscope).	8 (0) 30(-) 31(+) 2 (0) B-	Approx. 0 Ω in each case > 10V Rectangular pulses
1 1 4 1 1 2 4 1	Control unit	Motronic control unit defective.	—	—

FINAL-CONTROLLING-ELEMENT AND INPUT-SIGNAL DIAGNOSIS TEST TABLE

Flashing code	Testing of component/function	Test instructions/test conditions	Terminals	Set values
1 3 1 1	Injection valves	Pull plugs off all injection valves. Connect one injection valve in each case. The connected injection valve must function audibly. Perform test consecutively on all injection valves. Test injection-valve internal resistance. Check connecting leads from control unit to injection valves for short-circuit and open-circuit. Check Motronic-relay lead including series resistors.	— 17 14	2...3 Ω

FINAL-CONTROLLING-ELEMENT AND INPUT-SIGNAL DIAGNOSIS TEST TABLE (continued)

Flashing code	Testing of component/function	Test instructions/test conditions	Terminals	Set values
1 3 2 1	Idle actuator	Idle actuator must be heard or felt to function. Check internal resistance of idle actuator. Check leads from control unit and ignition/starting switch to idle actuator for short-circuit or open-circuit.	4	Approx. 8 Ω
1 3 2 2	Tank-ventilation valve	Tank-ventilation valve must be heard or felt to function. Check internal resistance of tank-ventilation valve. Check leads from control unit and ignition/starting switch to tank-ventilation valve for short-circuit or open-circuit.	5	35...55 Ω
1 3 3 2	Throttle-valve switch Idle contact	In the event of flashing-code output, slightly open throttle valve. Flashing code goes out if signal O.K.	52 19	Approx. 0 Ω
1 3 3 3	Throttle-valve switch Full-load contact	In the event of flashing-code output, open throttle valve completely. Flashing code goes out if signal O.K.	53 19	Approx. 0 Ω
1 3 3 4	Switch, air conditioning ready	In the event of flashing-code output, switch on A/C (if provided). Flashing code goes out if signal O.K.	41 B-	Approx. battery voltage
1 3 3 5	Switch, refrigerant compressor	Leave A/C switched on (if provided). Flashing code goes out if signals O.K.	40 B-	Approx. battery voltage

TEST SPECIFICATIONS

* Pressure regulator Fuel pressure	3,8 ±0,2 bar
* Electric fuel pump Fuel delivery (measured in return line) Supply voltage (under load):	min. 900 cm ³ /30s min. 12 V
* Temperature sensor (intake air) Internal resistance measured at air-flow sensor between term. 1 and term. 4 at ambient temperature (+15...+30 °C) :	1450...3300 Ω
* Temperature sensor (engine) Internal resistance at ambient temperature (+15...+30 °C) : Engine at operating temperature (approx. +80 °C) :	1450...3300 Ω 280... 360 Ω
* Solenoid-operated injection valve Internal resistance at ambient temperature (+15...+30 °C) :	2... 3 Ω
* Series resistors Resistance in each case	5... 7 Ω
* Air-flow sensor Internal resistance between: term. 2 and term. 4 : term. 3 and term. 4 :	8...2500 Ω (1) 500...1100 Ω

(1) Slowly deflect air-flow sensor flap as far as it will go.
Resistance fluctuates between the terminals of the potentiometer.

TEST SPECIFICATIONS (CONTINUED)

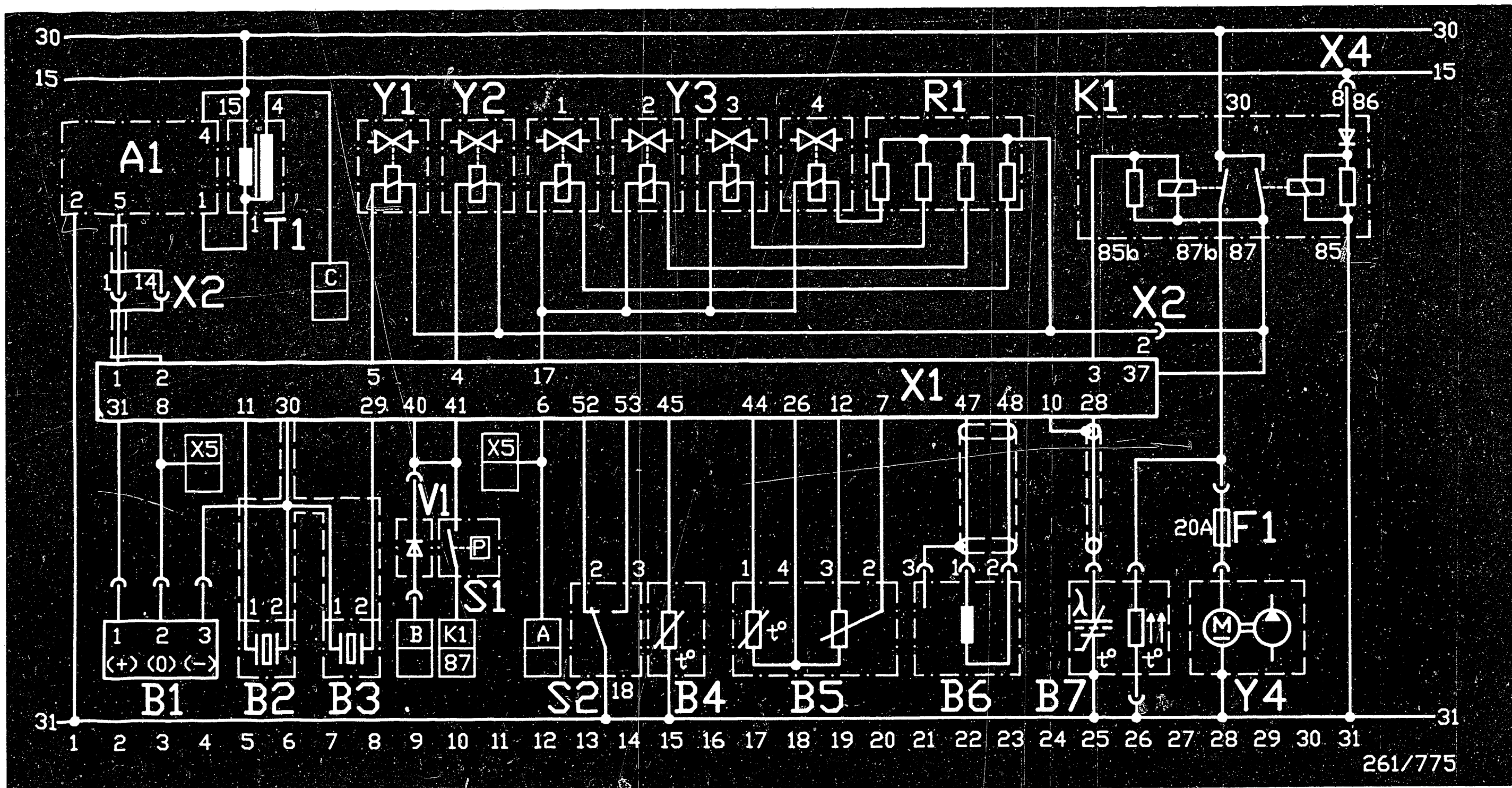
* Engine-speed sensor and reference-mark sensor Internal resistance between term. 1 and term. 2 at ambient temperature (+15...+30 °C) : Air gap:	400...800 Ω 0,8 ±0,3 mm
* Throttle-valve switch Resistance of idle contact (term. 2 and term. 18) : Resistance of full-load contact (term. 3 and term. 18):	0 Ω 0 Ω
* Idle actuator Internal resistance at +15...+30 °C between term. 2 and term. 2 :	8 Ω
* Lambda sensor Resistance of heater winding	1...15 Ω
* Ignition coil Primary resistance: Secondary resistance:	0,4...0,6 Ω 5,0...7,2k Ω
* Interference-suppression resistors H.T. distributor rotor: H.T. distributor dome: Spark-plug connector:	1 k Ω each 1 k Ω each 3 k Ω

TEST SPECIFICATIONS (CONTINUED)

* Magnetic pulse generator (Hall generator) Voltage supply with ignition "on": Function: rectangular pulse at cranking speed.	> 10V
* Tank-ventilation valve: Internal resistance at ambient temperature (+15...+30 °C) :	35...55 Ω
* Knock-sensor tightening torque: Do not use any lock washers!	15...25 Nm
* Ignition output stage (trigger box): Voltage supply with engine idling:	12...14 V
* Idle test: Engine at operating temperature, switch off loads. Idle speed: Spark-advance angle:	840 ±40 min ⁻¹ 10 ±3 °crankshaft.
* CO content (no catalytic converter) % CO.	: 0,5...1,5 vol
Adjust mixture at bypass screw in air-flow sensor: Turning in a counter-clockwise direction, makes the mixture leaner; turning in a clockwise direction makes the mixture richer.	
* Vehicles with catalytic converter % CO (measure CO ahead of catalytic converter if sampling point provided, disconnect plug of Lambda sensor).	: 0,4...1,2 vol.

For production reasons:
continued on the following
coordinate.

Please refer to equipment and Autodata microcard as
regards settings for other engine-related data.

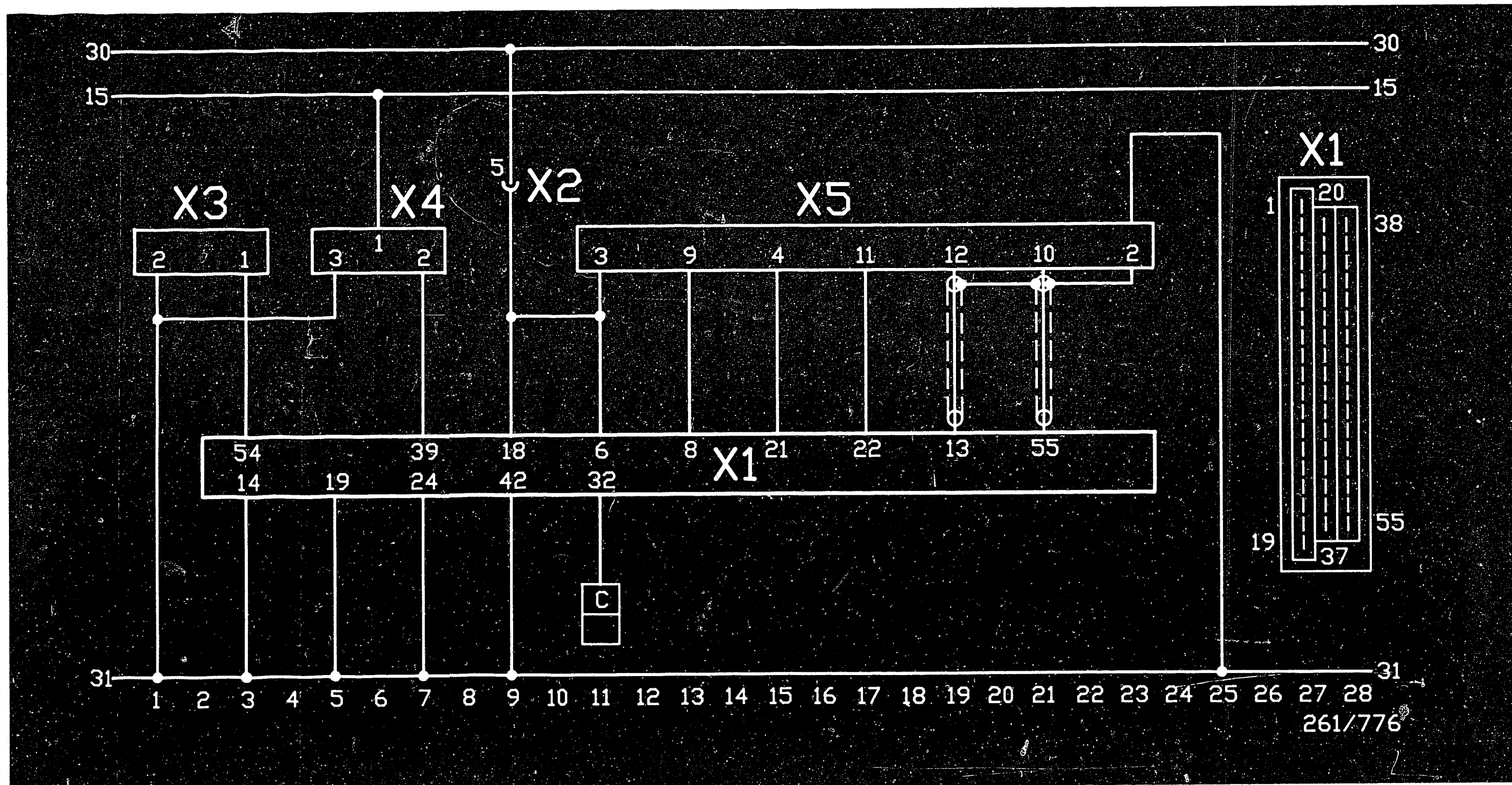


A1 = Ignition trigger box
 B1 = Magnetic pulse gen. (Hall generator)
 B2 = Knock sensor 1
 B3 = Knock sensor 2
 B4 = Temperature sensor (engine)
 B5 = Air-flow sensor
 B6 = Engine-speed/reference-mark sensor

B7 = Lambda sensor
 F1 = Fuel pump fuse
 K1 = Motronic relay
 R1 = Series resistors
 S1 = Switch, power-assisted steering
 S2 = Throttle-valve switch
 T1 = Ignition coil
 1 = Protective diode

X1 = Control-unit plug
 X2 = Engine plug
 Y1 = Tank ventilation valve
 Y2 = Idle actuator
 Y3 = Injection valves
 A = to tachometer
 B = to air conditioner
 C = to high-tension distributor

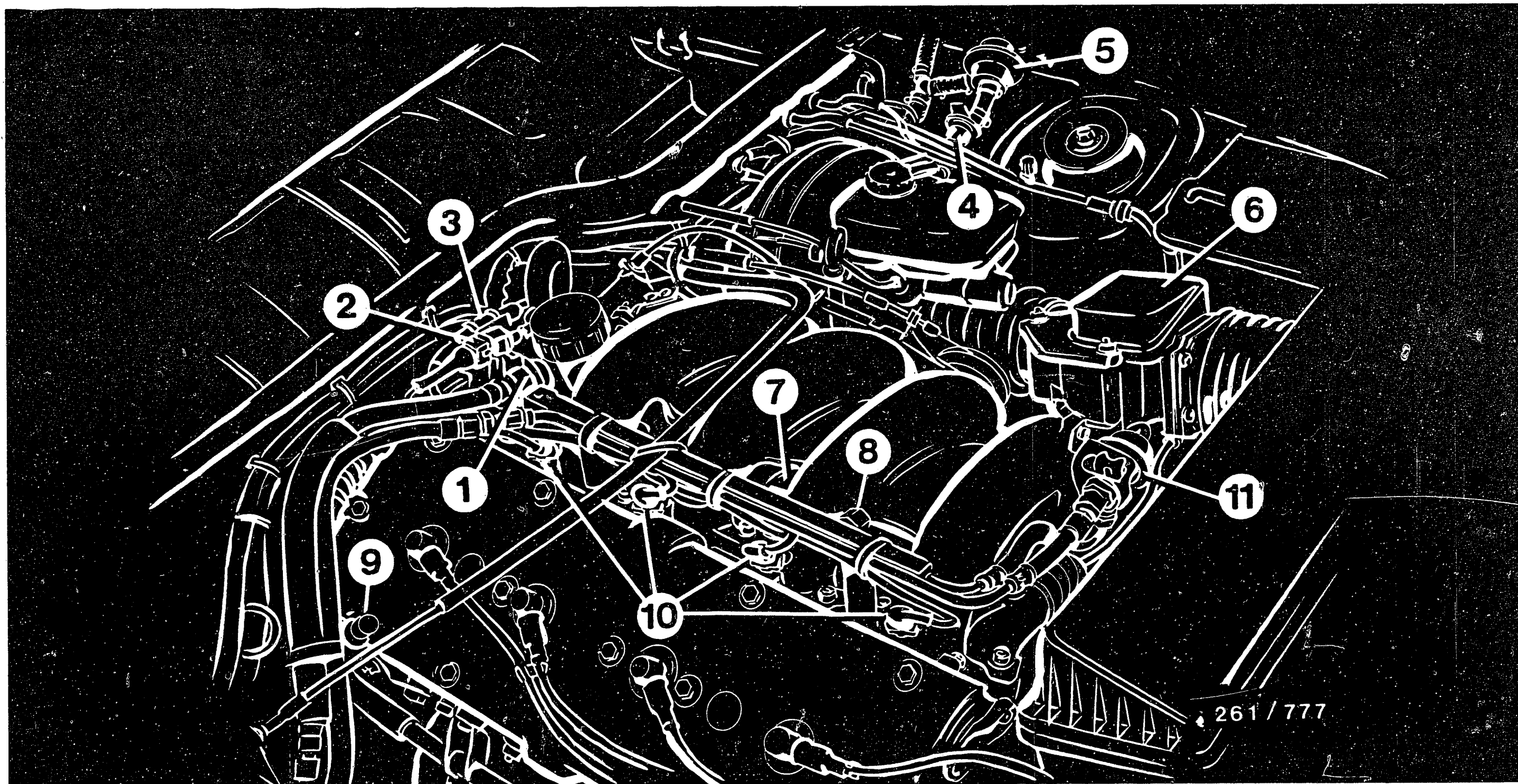
ELECTRICAL TERMINAL DIAGRAM



X1 = Control-unit plug
 X2 = Engine plug
 X3 = Encoding plug
 X4 = Variant plug

X5 = Diagnosis plug in
 passenger compartment
 C = to consumption indicator

ELECTRICAL TERMINAL DIAGRAM (continued)

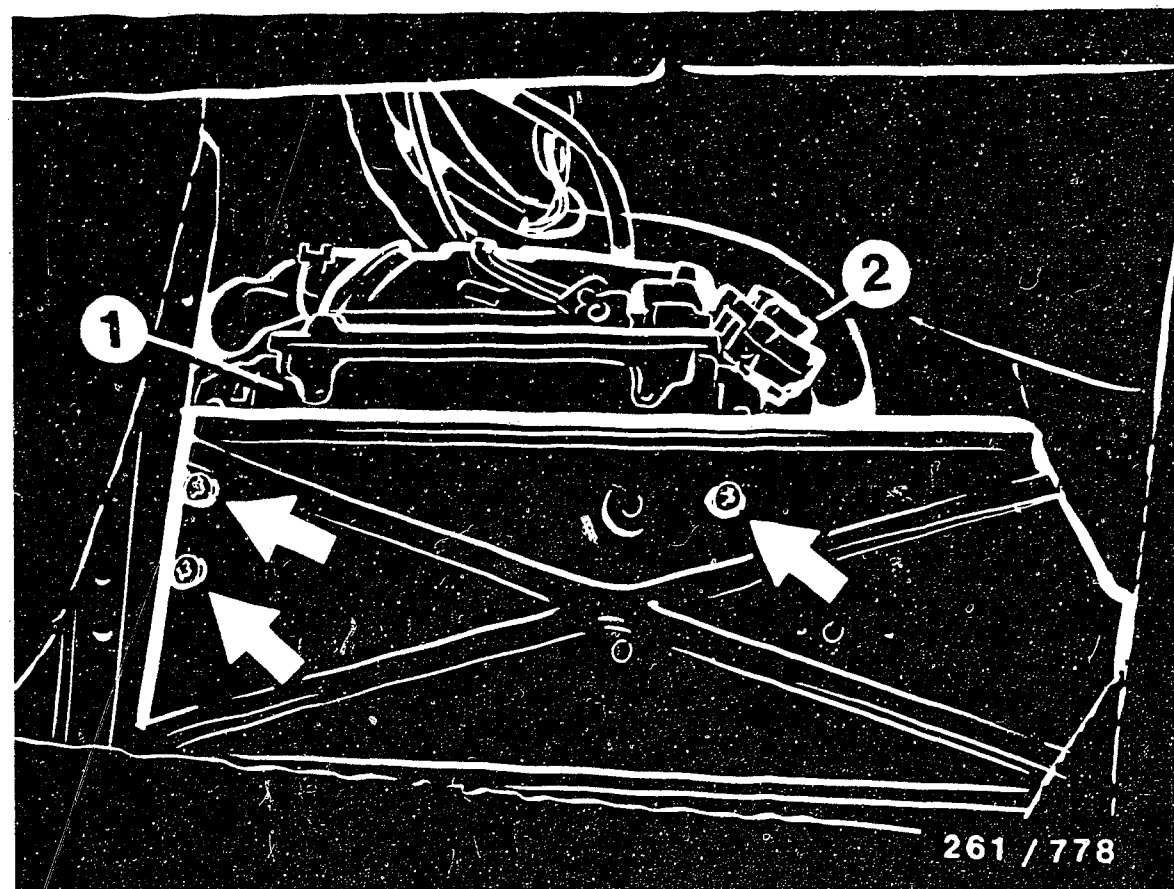


- 1 = Fuel pressure regulator
- 2 = Plug connection, engine-speed/
reference-mark sensor
- 3 = Plug connection,
Lambda sensor
- 4 = Tank-ventilation valve

- 5 = Diaphragm valve for
tank ventilation
- 6 = Air-flow sensor
- 7 = Idle actuator
- 8 = Test connection for
fuel pressure

- 9 = CO sampling point for
vehicles with catalytic converter
- 10 = Solenoid-operated injection valves
1 - 4
- 11 = Pressure damper

INSTALLATION POSITION OF COMPONENTS

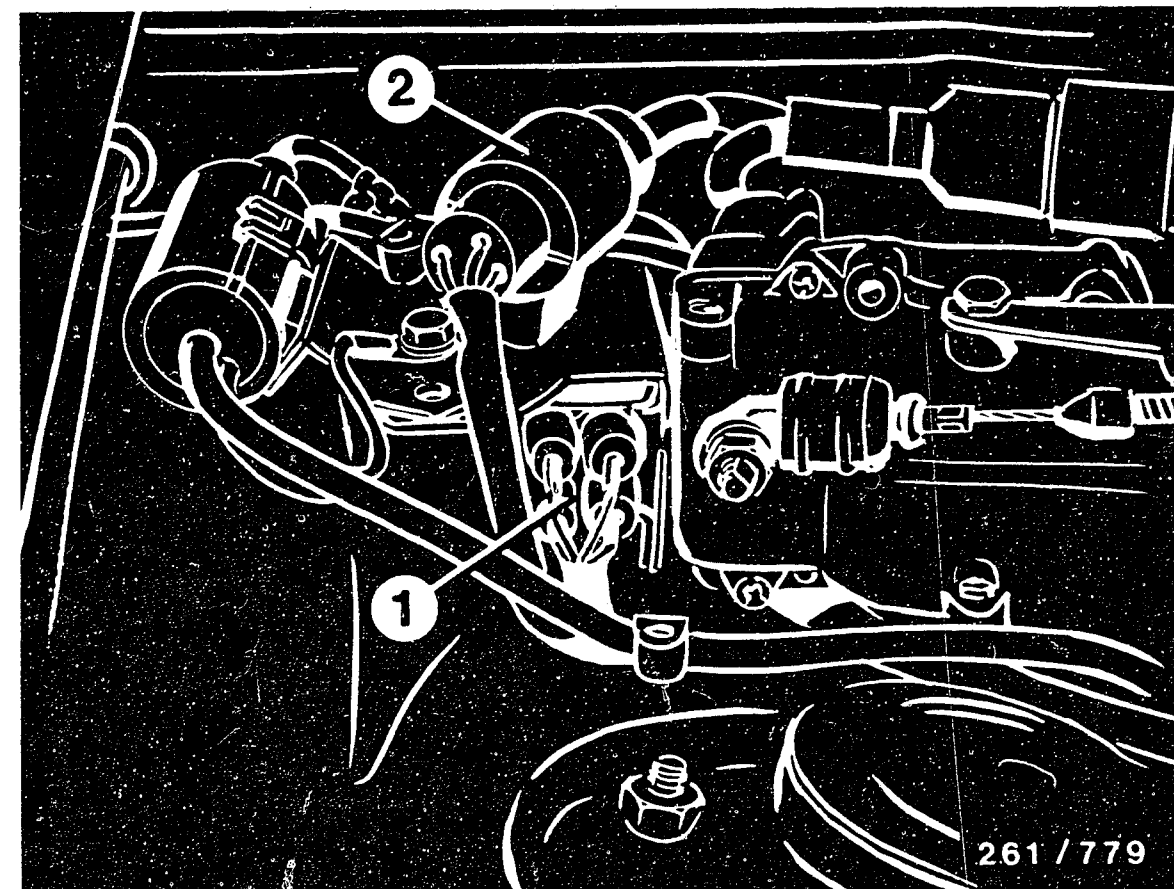


1 = Motronic control unit
2 = Diagnosis plug

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The Motronic control unit is located in the passenger-side footwell beneath the floor plate.

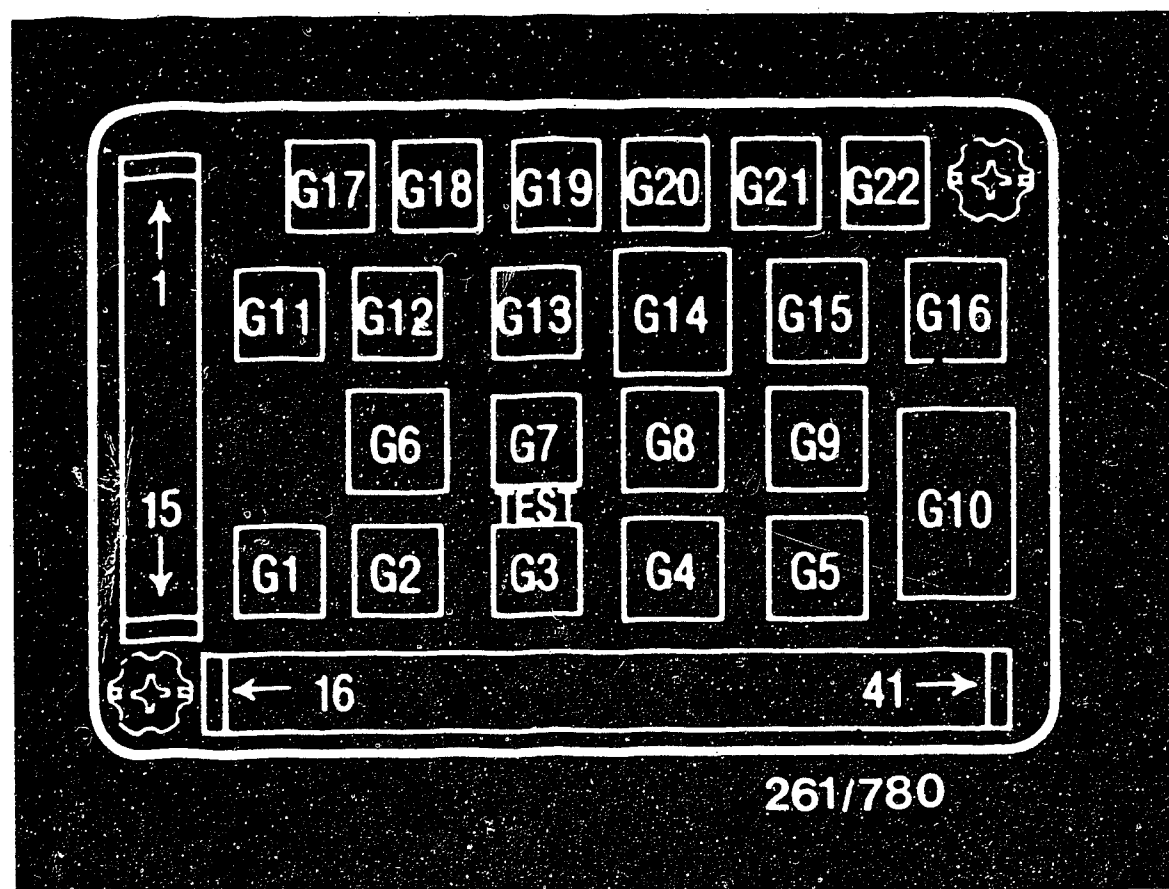
Loosen three screws (arrows) to remove control unit.



1 = Series resistors
2 = Plug connection

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The series resistors are located on the right in the direction of travel at the bulkhead.



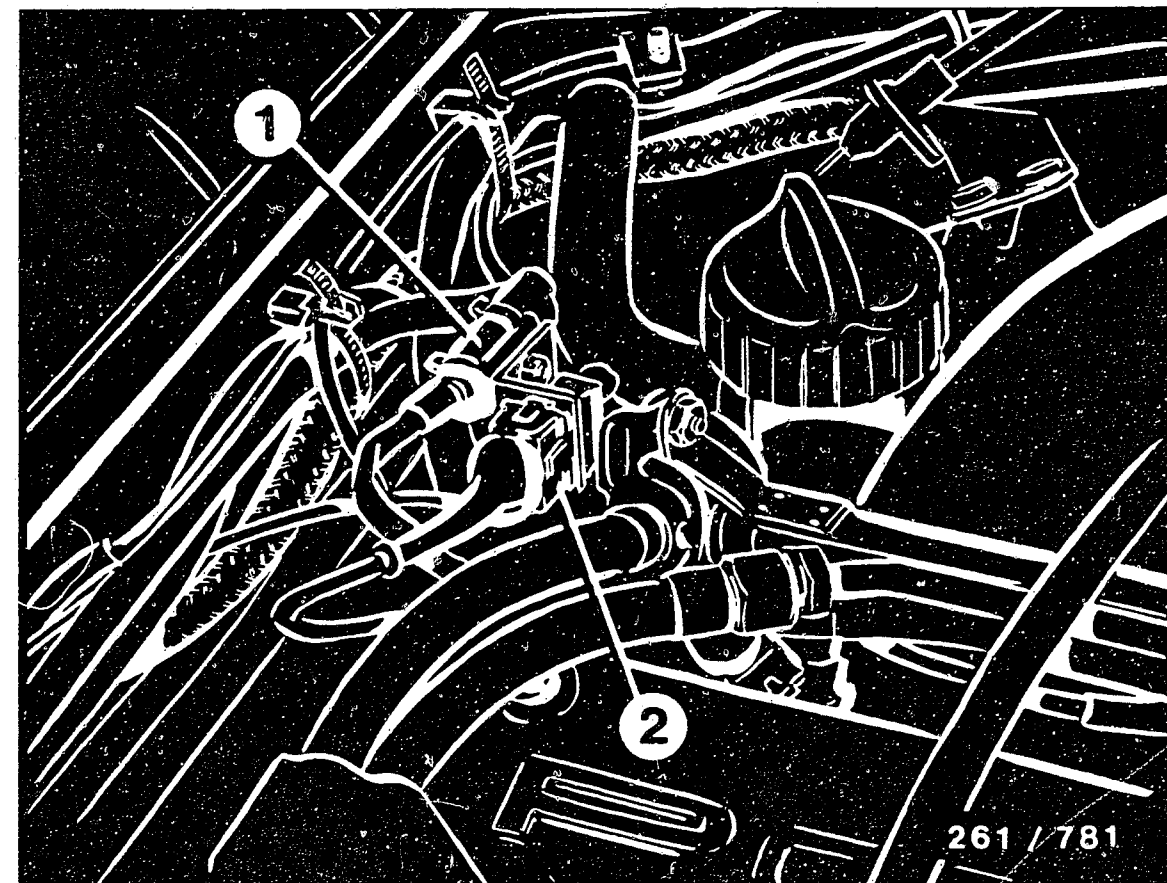
INSTALLATION POSITION OF COMPONENTS (CONTINUED)

* Motronic relay:

In central-electrics console, relay G5
(see picture).

* Fuse for electric fuel pump:

In central-electrics console, fuse No. 34



1 = Plug connection, Lambda sensor

2 = Plug connection, engine-speed/reference-mark
sensor

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Ignition trigger box:
On a heat sink on the left-hand inner fender near the headlight.
- * Throttle-valve switch:
Beneath the throttle-valve assembly.
- * Engine connector:
On bulkhead, left near servo unit.
- * Tank-ventilation system:
The tank-ventilation valve and diaphragm valve are located on the bulkhead, left.
- * Magnetic pulse generator (Hall generator):
Behind driving gear of outlet camshaft.
- * Ignition coil:
On right-hand inner fender.
- * Temperature sensor (engine):
At front of engine beneath intake manifold.
- * Idle actuator:
Between intake manifolds of cylinders 2 and 3.

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Knock sensor 1 (cylinders 1 + 2):
Beneath intake manifold, between cylinders 1 and 2.
- * Knock sensor 2 (cylinders 3 + 4):
Beneath intake manifold, between cylinders 3 and 4.

R e m o v a l :

The intake manifold must be removed for reasons of space, in order to be able to tighten the knock sensor to the prescribed torque.

- * Lambda sensor:
In joint exhaust pipe.
- * Electric fuel pump and fuel filter:
In rear of vehicle, near rear axle.

TABLE OF CONTENTS

Trouble-shooting instructions	: MB-5039
BOSCH system	: Automatic air conditioner
Make of vehicle	: MERCEDES-BENZ
Basic microcard	: MB-515

Section	Coordinate
Special features, safety, usage.....	02
Trouble-shooting chart.....	05
How to use the self-diagnosis with test table.....	07
Test specifications.....	15
Electrical terminal diagram.....	17
Installation position of components.....	23

SPECIAL FEATURES

This microcard contains the trouble-shooting instructions for the electronic automatic air conditioner in MERCEDES-BENZ vehicles

Type W 124: 200 D...300 TE (09.87 ->)
W 126: 260SE...560SEC (09.87 ->)

A control unit with self-diagnosis was introduced for the automatic air conditioner as of 09.87.

A separate temperature sensor has been built into these systems for determining the engine temperature.

Activation of the auxiliary fan (2nd stage) has been integrated into the control unit of the automatic air conditioner. The switching points of the auxiliary fan are different for diesel-engine and spark-ignition-engine vehicles.

Note: The control units for type 124 and type 126 are not compatible. They differ in terms of the evaluation of the speed signal.

Notes on circuit diagram:
This microcard features a circuit diagram in place of the schematic diagram. The circuit diagram consists of a basic diagram and follow-up diagrams for the various vehicles. The vehicle-specific versions are indicated by means of dashed lines. If reference is made within the circuit diagram to a follow-up diagram, first the current path and then the component is indicated in the reference box. If reference is made to components not indicated on the circuit diagram, first the components and then the terminals are indicated in the reference box.

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

In line with the customer complaint, the trouble-shooting chart leads to various causes/component faults.

A detailed description of trouble-shooting is given in the trouble-shooting chart in the basic instructions.

NOTE: Even if reference is made to basic instructions, the set values, terminal assignments and special features indicated in these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Pay attention to information given in basic instructions so as to avoid endangering people and in order to prevent damage to engine, trigger boxes, control units or ignition system.

IMPORTANT!

Heavy duty ignition system with hazardous high and low voltage!

Coming into contact with components or terminals which carry voltage may be fatal (on both primary and secondary sides).

For production reasons:
continued on the following
coordinate.

TROUBLE-SHOOTING CHART

Customer complaint (Symptoms of trouble)

1. No or poor heating effect
2. No or poor cooling effect
3. Heating blower cannot be regulated
4. Heating blower does not throttle back at high speed
5. Incorrect air distribution
6. Circulatory operation not possible
7. Auxiliary fan is not switched in
8. Idling problems on switching in the refrigerant compressor

Cause (component fault)

*	*	*	*	*	*	*	Evaluate self-diagnosis
*							Refrigerant level too low
	*						Check refrigerant level
	*						Drier defective
	*						Condenser dirty
*							Auxiliary heating-water pump open-circuit or mechanically defective
*	*						Heating-water valve open-circuit or mechanically defective
	*						Check control unit of compressor cutoff
	*						Check TD signal to control unit of compressor cutoff
	*						Check speed sensor of refrigerant compressor
	*					*	Pressure switch defective

TROUBLE-SHOOTING (Continued)

Customer complaint (symptoms of trouble)

1. No or poor heating effect
2. No or poor cooling effect
3. Heating blower cannot be regulated
4. Heating blower does not throttle back at high speed
5. Incorrect air distribution
6. Circulatory operation not possible
7. Auxiliary fan is not switched in
8. Idling problems when switching in the refrigerant compressor

Cause (component fault)

*		*					Check blower regulator
*			*				Blower motor defective
	*						Auxiliary fan open-circuit or mechanically defective
					*		Check series resistor of auxiliary fan
*	*			*			Adjusting flaps mechanically defective
				*	*		Open-circuit in change-over valves or valves mechanically defective
*	*			*	*		Check vacuum system
*	*						Check sensor blower
				*	*	*	Control unit defective
			*				Check speed signal
						*	Check activation lead to control unit of mixture-preparation

HOW TO USE THE SELF-DIAGNOSIS AND SELF-DIAGNOSIS TEST TABLE

Installed in this vehicle is a control unit which has a self-diagnosis facility. Therefore trouble-shooting must always be started with self-diagnosis.

The indicated faults in the automatic air conditioner are broken down in the self-diagnosis test table which starts on coordinates 09. The self-diagnosis test table contains fault indication, component tested, test terminals at control-unit plug (in the case of terminals other than at the control-unit plug, the plugs are indicated in the remarks column), cause of trouble, test instructions and set values. Unless otherwise indicated, the tests are to be performed with control-unit plugs detached.

Only proceed in accordance with the trouble-shooting charts as of coordinates 05, if no fault is stored in the fault memory, but there is nevertheless a customer complaint. The trouble-shooting charts only list those components which are not tested via the self-diagnosis.

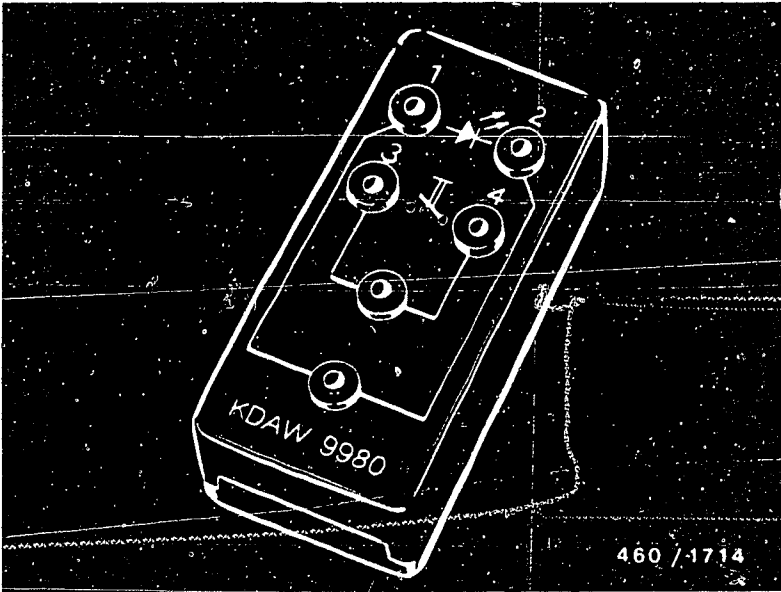
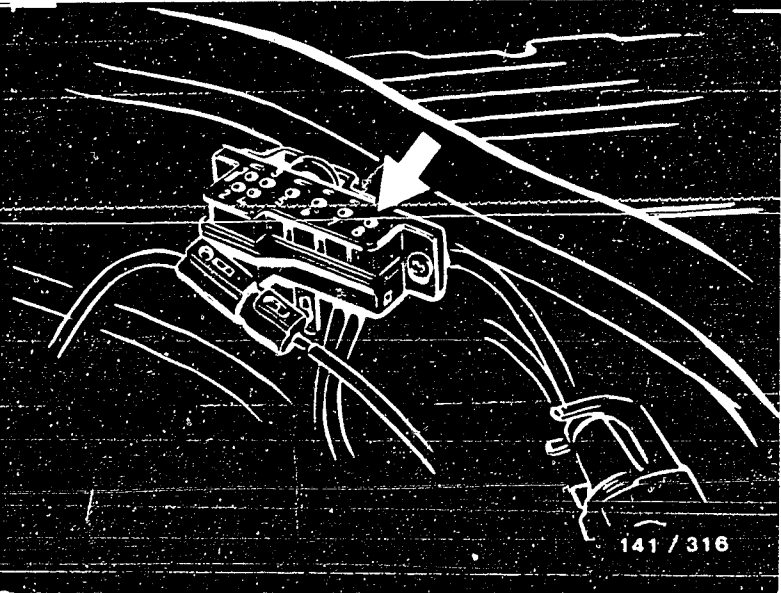
Activating the self-diagnosis:

Connect sockets KDAW 9980 and 2 of the flashing-code evaluation unit to socket 4 of the test coupling for diagnosis (upper illustration). Connect evaluation-unit socket 7 to battery +VE and socket 1 to ground (socket 3 of diagnosis coupling). Switch on ignition. Press push-button on evaluation unit for approx. 1 s. Output of the self-diagnosis begins approx. 1 s. after stimulation with the first flashing code.

Continuing diagnosis:

After a fault has been read out, the next fault is output by pressing the push-button again. Diagnosis output can be ended only by switching off the ignition. The LED in the fresh-air/recirculating-air switch flashes during diagnosis output. Repeat output of self-diagnosis as a check after eliminating the indicated faults.

N o t e :
The control-unit outputs - compressor actuation, auxiliary heating-water pump, heating-water valve, flap change-over valves and auxiliary fan actuation - are only checked for short-circuit by the self-diagnosis.



SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
1	Control unit and periphery	No fault present in system.	—	—
3	Open-circuit in passenger-compartment temperature sensor	Check resistance of passenger-compartment temperature sensor: at 15°C: at 35°C: Check leads for short-circuit and open-circuit.	R2 R10	Approx. 15,2...17,2 k Ω
2	Short-circuit in passenger-compartment temperature sensor		R2 R10	Approx. 6,0... 7,0k Ω
5	Open-circuit in ambient-temperature sensor	Check resistance of ambient-temperature sensor: at 10°C: at 35°C: Check leads for short-circuit and open-circuit.	R9 R10	Approx. 5,0... 6,0k Ω
4	Short-circuit in ambient-temp. sensor		R9 R10	Approx. 1,6... 2,0k Ω
7	Open-circuit in evaporator-temperature sensor	Check resistance of evaporator-temperature sensor: at 10°C: at 35°C:	R4 R10	Approx. 18,3...21,5k Ω
6	Short-circuit in evaporator temperature sensor		R4 R10	Approx. 6,0... 7,0k Ω
9	Open-circuit in discharge-temperature sensor	Check resistance of discharge-temperature sensor: at 15°C: at 35°C: Check leads for short-circuit and open-circuit.	R7 R10	Approx. 15,2...17,2k Ω
8	Short-circuit in discharge-temperature sensor		R7 R10	Approx. 6,0... 7,0k Ω
13	Open-circuit in coolant-temperature sensor	Check resistance of coolant-temperature sensor: at 20°C: at 100°C: Check leads for short-circuit and open-circuit.	R8 R10	Approx. 5,0... 8,0k Ω
12	Short-circuit in coolant-temperature sensor		R8 R10	Approx. 300... 400 Ω

SELF-DIAGNOSIS TEST TABLE (Continued)

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
30	Short-circuit in auxiliary heating-water pump	Ignition switched on. Check supply voltage for auxiliary heating-water pump: Check heating-water pump and connecting leads for short-circuit.	L10 R12	Greater than 10 V
31	Short-circuit in Mono heating-water valve	Ignition switched on. Check supply voltage of heating-water valve: Check heating-water valve and connecting leads for short-circuit.	L9 R12	Greater than 10 V
33	Short-circuit in control unit of compressor cutoff	Control-unit plug attached. Ignition switched on. Check supply voltage for compressor relay: Check contacts of compressor relay (corrosion or lead come off). Check actuation lead for control unit of compressor cutoff for short-circuit.	L7 R12	Greater than 10 V
34	Short-circuit in auxiliary fan	Check resistance of auxiliary fan relay: Check lead to relay of auxiliary fan for short-circuit.	R11 R12	Approx. 50...80 Ω
50	Short-circuit in change-over valve, defroster outlet, long stroke	Ignition switched on. Check supply voltage for change-over valve: Check resistance directly at plug-in base of change-over valve strip: Check leads to change-over valve for short-circuit	L5 R12 5 8	Greater than 10 V Approx. 50...80 Ω
51	Short-circuit in change-over valve, defroster outlet, short stroke	Ignition switched on. Check supply voltage for change-over valve: Check resistance directly at plug-in base of change-over valve strip: Check leads to change-over valve for short-circuit.	L8 R12 7 8	Greater than 10 V Approx. 50...80 Ω

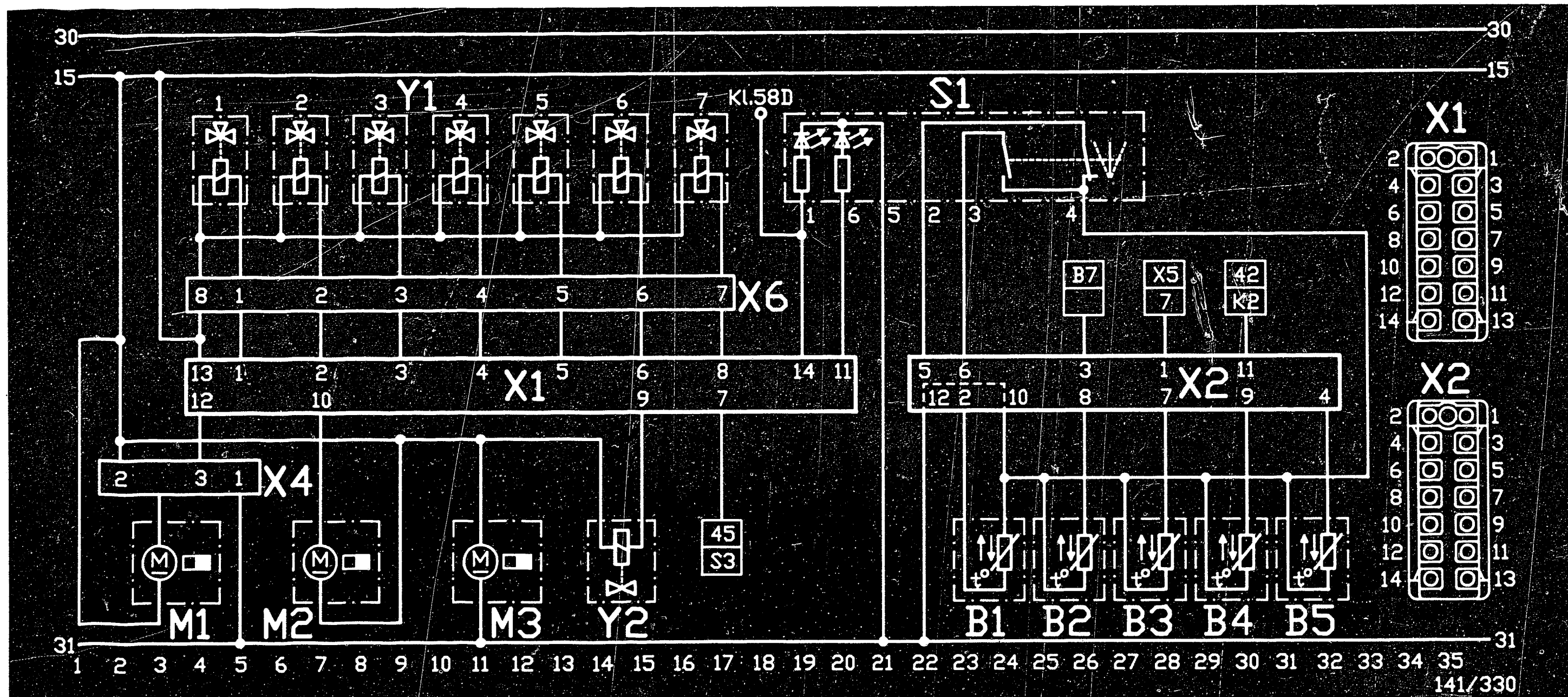
SELF-DIAGNOSIS TEST TABLE (Continued)

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
52	Short-circuit in change-over valve, footwell flaps	Ignition switched on. Check supply voltage for change-over valve: Check resistance directly at plug-in base of change-over valve strip: Check leads to change-over valve for short-circuit.	L3 R12 3 8	Greater than 10 V Approx. 50...80 Ω
54	Short-circuit in change-over valve, center-outlet flaps	Ignition switched on. Check supply voltage for change-over valve: Check resistance directly at plug-in base of change-over valve strip: Check leads to change-over valve for short-circuit.	L4 R12 4 8	Greater than 10 V Approx. 50...80 Ω
55	Short-circuit in change-over valve, air renewal flap	Ignition switched on. Check supply voltage for change-over valve: Check resistance directly at plug-in base of change-over valve strip: Check leads to change-over valve for short-circuit.	L6 R12 6 8	Greater than 10 V Approx. 50...80 Ω
56	Short-circuit in change-over valve, fresh-air/circulating-air flap, long stroke	Ignition switched on. Check supply voltage for change-over valve: Check resistance directly at plug-in base of change-over valve strip: Check leads to change-over valve for short-circuit.	L2 R12 2 8	Greater than 10 V Approx. 50...80 Ω
57	Short-circuit in change-over valve, fresh-air/circulating-air flap, short stroke	Ignition switched on. Check supply voltage for change-over valve: Check resistance directly at plug-in base of change-over valve strip: Check leads to change-over valve for short-circuit.	L1 R12 1 8	Greater than 10 V Approx. 50...80 Ω
63	Short-circuit in heating-aid actuator	Ignition switched on. Only fitted as special equipment. Coolant temperature less than 50 °C. Control-unit plug connected. Temperature selection wheel engaged in "max." setting.	R14 R12	Greater than 10 V

TEST SPECIFICATIONS

	<u>Internal resistance</u>
Passenger-compartment temperature sensor	3,5...21,5 k Ω at 45... 10° °C
Discharge-temperature sensor	3,5...21,5 k Ω at 45... 10° °C
Evaporator-temperature sensor	3,5... 35 k Ω at 45... 0° °C
Ambient-temperature sensor	1,1... 6,0 k Ω at 45... 10° °C
Heating-water valve	Approx. 10... 20 Ω
Coolant-temperature sensor	Approx. 300...8,0 k Ω at 100... 20 °C
Change-over-valves internal resistance	Approx. 50...80 Ω
Heating-water-pump power consumption:	Max. 1 A
	<u>Switching points</u>
Low-pressure switch, compressor	Off at 2,0 bar On at 2,6 bar
High-pressure switch, compressor	Off at 30 bar On at 22 bar
Pressure switch, auxiliary fan	Off at 15 bar On at 20 bar

For production reasons:
continued on the following
coordinate.



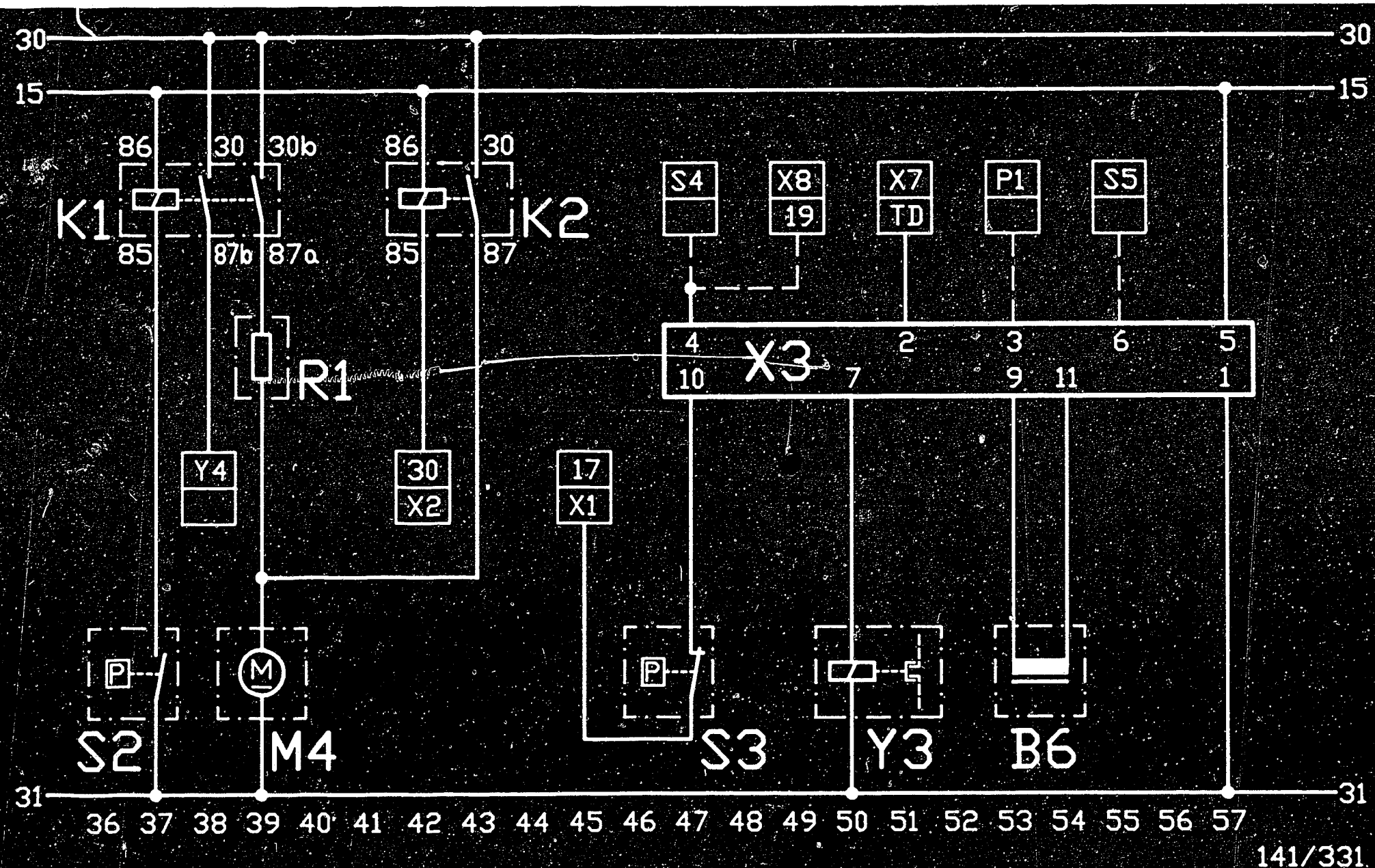
B1 = Passenger-compartment temp. sensor
 B2 = Coolant temperature sensor
 B3 = Discharge-temperature sensor
 B4 = Ambient-temperature sensor
 B5 = Evaporator temperature sensor
 B7 = Speed signal sensor
 K2 = Relay, auxiliary fan
 M1 = Blower motor
 M2 = Heating-water pump
 M3 = Vent. blower, pass.-compart. sens.
 S1 = Fresh-air/circulating-air switch

S3 = Refrigerant-compressor press. switch
 X1 = Control-unit plug, automatic air conditioner, left
 X2 = Control-unit plug, automatic air conditioner, right
 X4 = Plug, blower regulator
 X5 = Test coupling, diagnosis
 X6 = Plug, change-over valve strip
 Y1 = Change-over valve strip
 Y2 = Mono heating-water valve

1 = Fresh-air/circulating-air flap, short stroke
 2 = Fresh-air/circulating-air flap, long stroke
 3 = Footwell flaps
 4 = Center-outlet flap
 5 = Defroster-outlet flaps, long stroke
 6 = Air renewal flap
 7 = Defroster-outlet flaps, short stroke

Terminals 10 and 11 are connected internally in the control unit.

ELECTRICAL TERMINAL DIAGRAM, AUTOMATIC AIR CONDITIONER, 4-, 5-, 6-cylinder engines

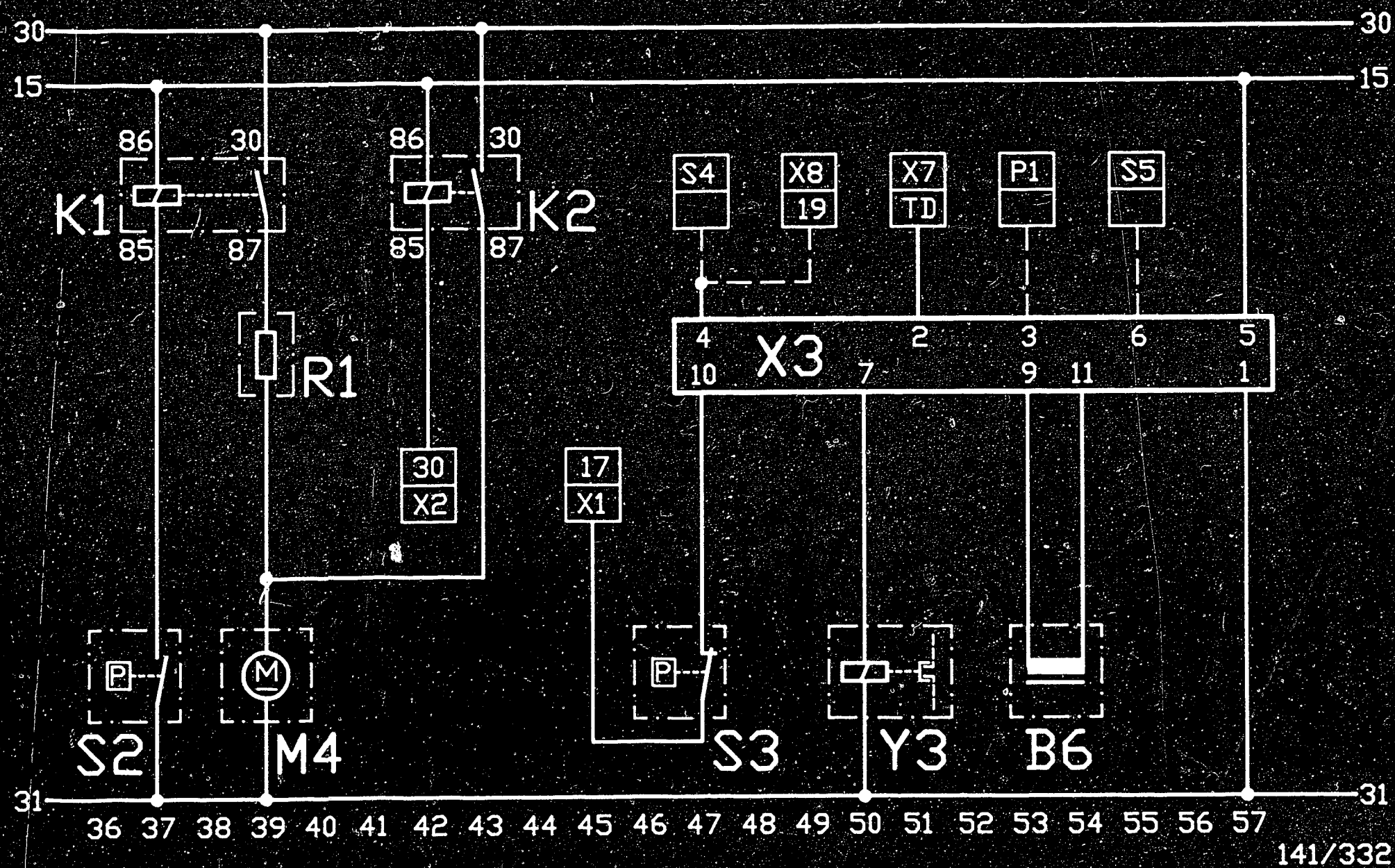


B6 = Speed sensor, refrigerant compressor
 K1 = Relay, auxiliary fan, series resistor
 K2 = Relay, auxiliary fan
 M4 = Auxiliary fan
 P1 = Rev. counter
 R1 = Series resistor, auxiliary fan
 S2 = Pressure switch, auxiliary fan
 S3 = Pressure switch, refrigerant compressor

S4 = Microswitch for compressor cutoff *
 S5 = Kick-down switch *
 X3 = Base, compressor cutoff unit
 X8 = Plug, control unit, mixture preparation
 X7 = Plug, EI/TI trigger box/speed sensor
 Starting rim or CU, idle-speed control *
 Y3 = Compressor coupling
 Y4 = Magnetic clutch, motor fan

* Only for diesel-engine vehicles with automatic transmission.

ELECTRICAL TERMINAL DIAGRAM, AUTOMATIC AIR CONDITIONER (Cont. 4-cylinder engines)



B6 = Speed sensor, refrigerant compressor
 K1 = Relay, auxiliary fan, series resistor
 K2 = Relay, auxiliary fan
 M4 = Auxiliary fan
 P1 = Rev. counter
 R1 = Series resistor, auxiliary fan
 S2 = Pressure switch, auxiliary fan

S3 = Pressure switch, refrigerant compressor
 S4 = Microswitch for compressor cutoff*
 S5 = Kick-down switch *
 X3 = Base, compressor cutoff unit
 X8 = Plug, KE control unit
 X7 = Plug, EI trigger box or control unit
 Idle-speed control *
 Y3 = Compressor coupling

* Only for diesel-engine vehicles with automatic transmission.

ELECTRICAL TERMINAL DIAGRAM, AUTOMATIC AIR CONDITIONER (Cont. 5 and 6-cylinder engines)

INSTALLATION POSITION OF COMPONENTS

The installation position of the components is the same as for the basic instructions.

The test coupling for diagnosis output is installed in the engine compartment next to the battery.

For production reasons:
continued on the following
coordinate.

Brief instructions : MB-5038

BOSCH system : Electronic ignition (FT)

Make of vehicle : MERCEDES-BENZ

Basic microcard : PKW-059

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SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Mercedes-Benz Model:

190 E 2.6, with 2.6 l/ 6-cyl. engine 103.942 9.86 ->.

Worldwide excluding USA, Japan, Australia.

- * EI control unit 0 227 400 583 -> 7.87
- * EI control unit 0 227 400 656 8.87 -> (with current limitation)
- * Ignition coil 0 221 5..
- * Trimming plug, ignition is located on left-hand wheelhouse.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.

For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

How to use rapid diagnosis chart

Use is to be made of rapid diagnosis chart as of coordinate A07 , if primary signal/ignition spark is present.

Use is to be made of rapid diagnosis chart as of coordinate A11 , if there is no primary signal/ignition spark.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (Engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (Ignition, injection).
6. Maximum engine power/ top speed not reached.
7. Fuel consumption too high.
8. Engine running on.
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (Component fault)										
*			*							High-tension side
*										Firing sequence
*			*							Ignition coil
*										Contact resistance
				*	*		*	*		Pressure sensor
				*	*					Temperature sensor - coolant
				*	*		*			Spark-advance angle
				*	*		*	*		Throttle-valve switch - idle
			*							Voltage: EI control unit, ignition coil (engine idling)

TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems
(Engine speed, exhaust gas).
4. Poor throttle take-up,
flat spot during acceleration.
5. Engine missing
(Ignition, injection).
6. Maximum engine power/
top speed not reached.
7. Fuel consumption too high.
8. Engine running on.
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

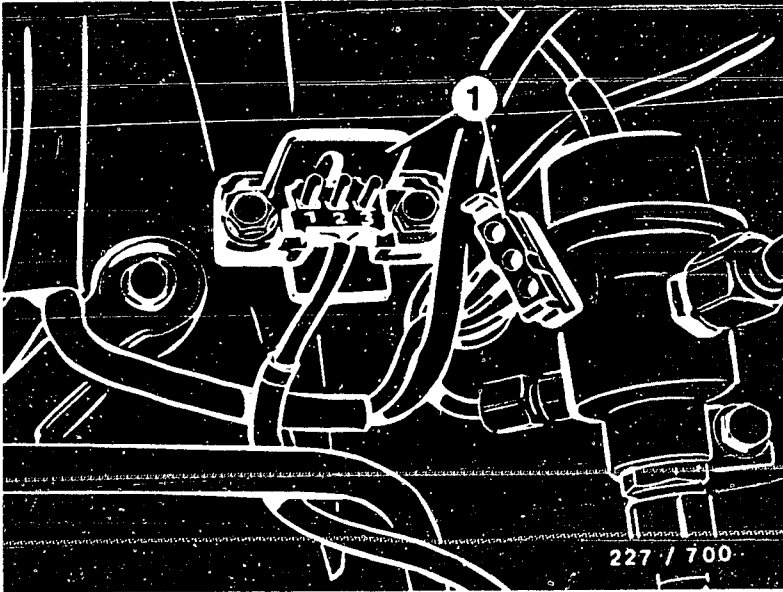
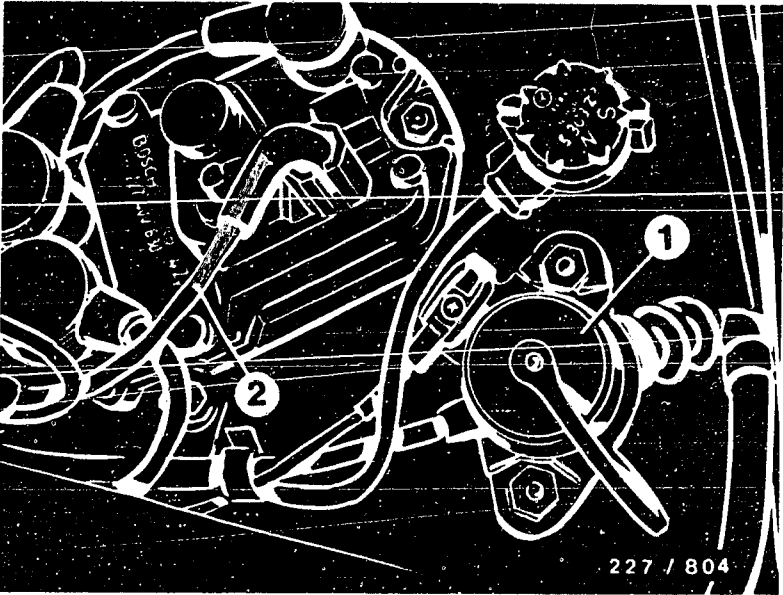
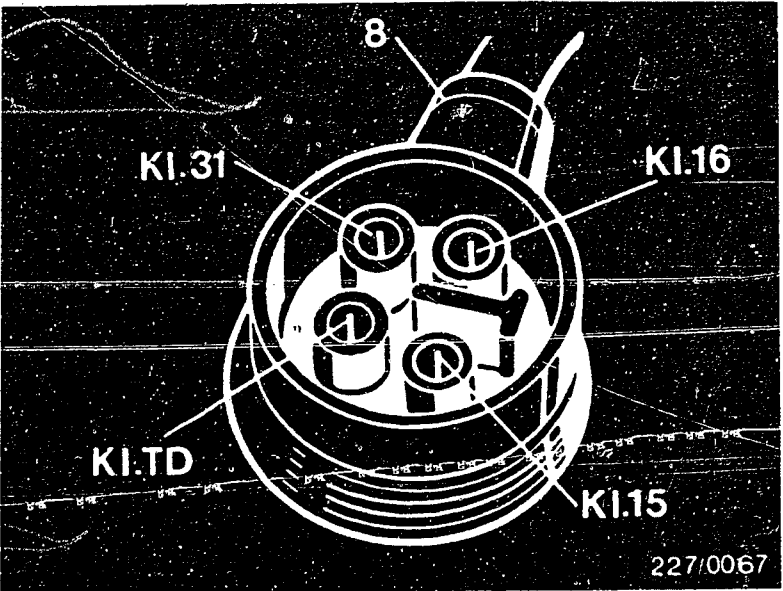
						Cause (Component fault)
*						Peak-coil-current cutoff
		*				Primary voltage
*						Insulation, pulse generator
*						Internal resistance, pulse generator
*						Voltage, pulse generator
*						Voltage, EI control unit
*						Voltage, primary circuit

For production reasons:
continued on the following
coordinate.

RAPID DIAGNOSIS CHART
Primary signal/ignition spark present

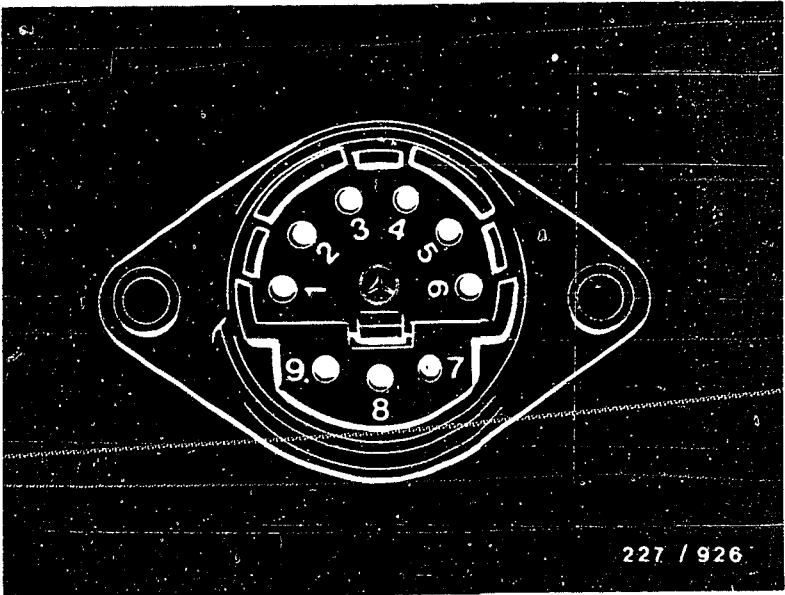
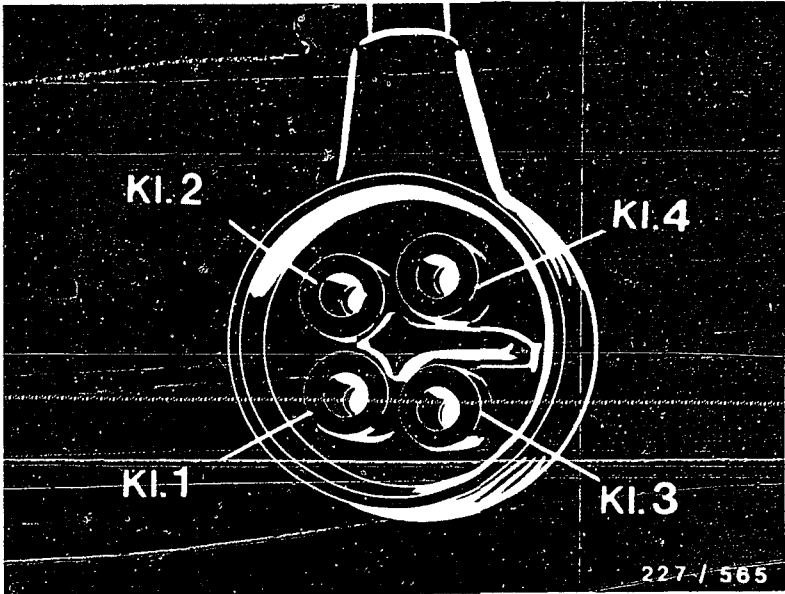
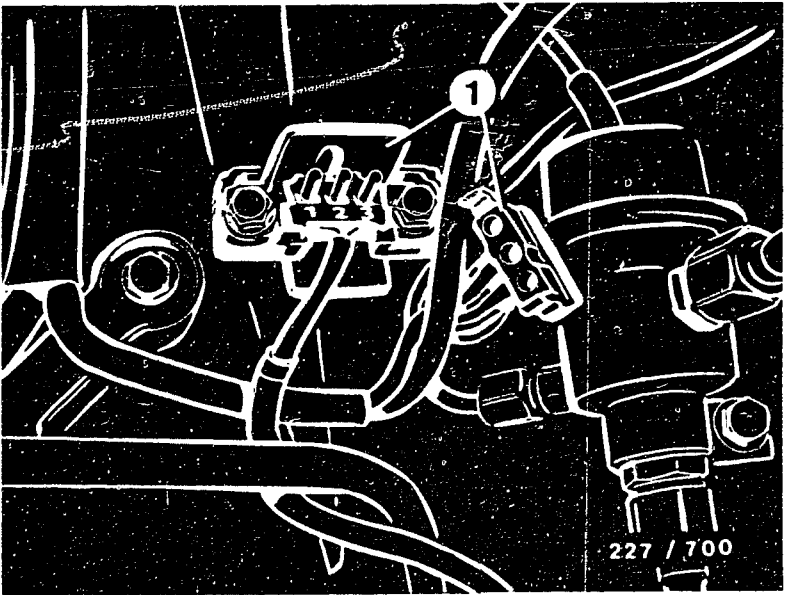
Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
1	HIGH-TENSION SIDE Check functioning (e.g. open-circuit, shunt) of for example spark plugs, ignition harness and distributor cap. Assessment for example by way of ignition oscillogram, resistance measurement, visual inspection.	—	—
2	IGNITION COIL Primary resistance Secondary resistance	1 15 1 4	0,3... 0,6 Ω 7,3...12,2 k Ω
3 *	CONTACT RESISTANCES (primary side) Disconnect - and + leads from battery. Ignition ON. Resistance from battery terminal to EI control-unit plug. See top picture. Resistance from battery terminal to ignition coil. Resistance from EI control-unit plug to ignition coil.	B+ 15 B- 31 B+ 15 16 1	max. 0.3 Ω max. 0.3 Ω
4	PRESSURE SENSOR Detach vacuum hose, EI control unit. See center picture, item 2. Disconnect plug connection of throttle-valve switch. See bottom picture. Engine at idle. Read off spark-advance angle. Attach vacuum hose, EI control unit.	—	ADVANCE spark-advance angle
5	TEMPERATURE SENSOR - COOLANT Engine at operating temperature. Detach vacuum hose, EI control unit. See center picture, Item 2. Detach plug connection of throttle-valve switch. See bottom picture Engine at idle. Read off spark-advance angle. Detach temperature-sensor plug (not illustrated).	—	Change in spark-advance angle

* Perform only with engine not running.



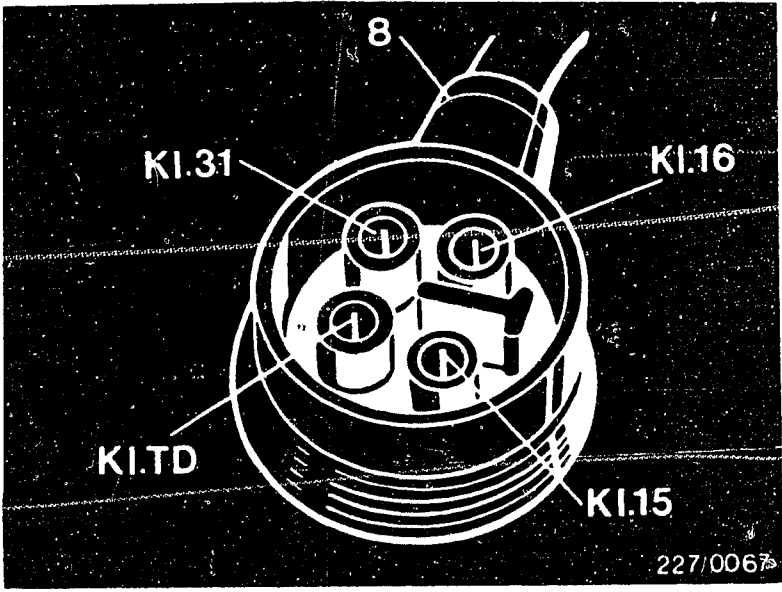
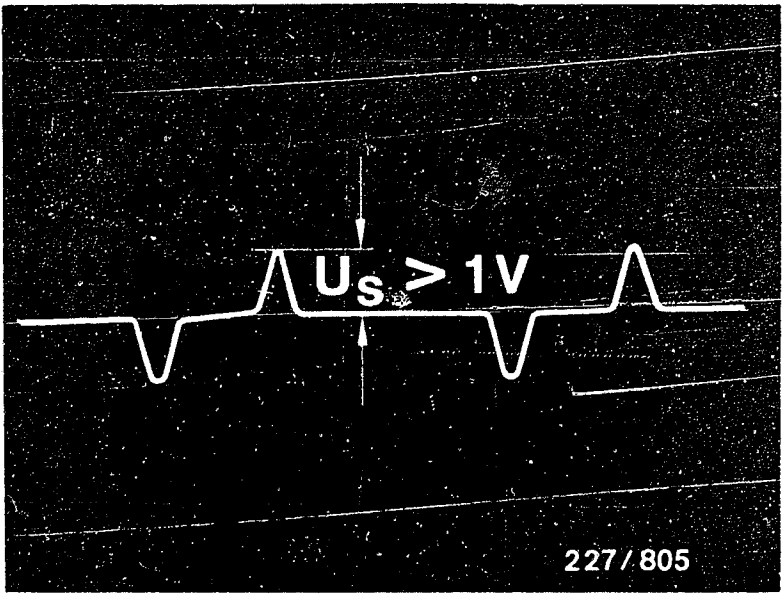
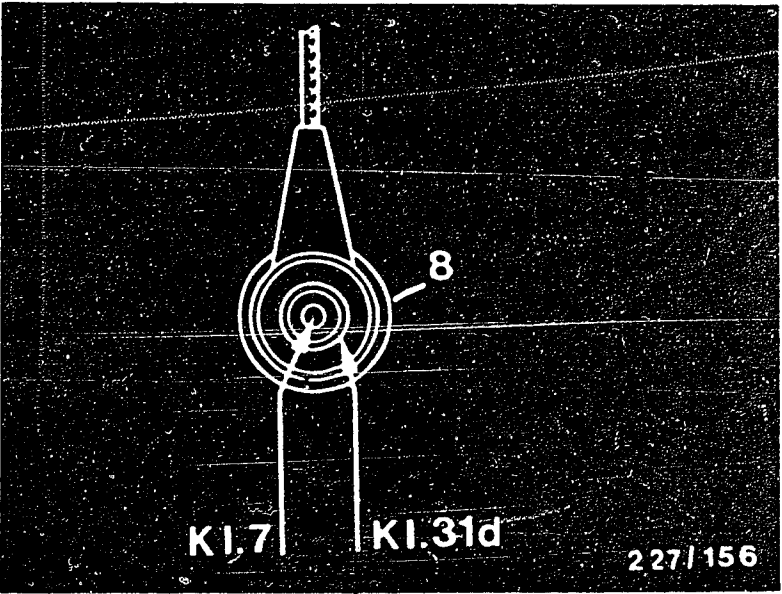
RAPID DIAGNOSIS CHART (continued)
Primary signal/ignition spark present

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
6	SPARK-ADVANCE ANGLE Detach vacuum hose, EI control unit. Detach plug connection of throttle-valve switch. See top picture, item 1. Engine at operating temp., however < 95° C. Run engine at 3200 min ⁻¹ .	—	Trimming-plug setting " S " 25...29° BTDC Trimming-plug setting " N " 19...23° BTDC
7	IDLE THROTTLE-VALVE SWITCH Detach KE-Jetronic control unit plug. Connect plug connection of throttle-valve switch. See top picture, item 1. Resistance, EI control-unit plug and battery terminal. See center picture. Throttle valve - idle position Throttle valve - part-load position	2 B-	Approx. 0 Ω (continuity) Infinity Ω (open-circuit)
8	VOLTAGE, EI CONTROL UNIT AND IGNITION COIL Voltage, diagnosis socket and battery terminal. See bottom picture. Engine at idle.	5 B- (+) (-)	12 - 14 V max. 1 V below U _B
9	PEAK-COIL-CURRENT CUTOFF Voltage, diagnosis socket. See bottom picture. Ignition ON.	5 4 (+) (-)	after app. 1 s 0 V
10	PRIMARY VOLTAGE Oscilloscope with pulse-shaping circuit at ignition coil. Engine at idle.	15 1 (+) (-)	280...360 V



RAPID DIAGNOSIS CHART (continued)
No primary signal/ignition spark present

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
1	INSULATION, PULSE GENERATOR Resistance, EI control-unit plug and battery -. See top picture	7 8-	infinity Ω
2	INTERNAL RESISTANCE, PULSE GENERATOR Resistance, EI control-unit plug. See top picture.	7 31d	680...1200 Ω
3	VOLTAGE, PULSE GENERATOR Voltage (oscilloscope - "Special") EI control-unit plug. See top picture. Start engine.	7 31d (+) (-)	$U_s > 1\text{ V}$ (Center picture)
4	VOLTAGE, EI CONTROL UNIT Voltage, EI control-unit plug. See bottom picture. Ignition ON.	15 31 (+) (-)	Battery voltage
5	VOLTAGE, PRIMARY CIRCUIT Voltage, EI control-unit plug. See bottom picture. Ignition ON.	16 31 (+) (-)	Battery voltage
6	IGNITION COIL Primary resistance Secondary resistance	1 15 1 4	0,3... 0,6 Ω 7,3...13,2 k Ω



TEST SPECIFICATIONS

Ignition coil, primary	0,3... 0,6 Ω
Ignition coil, secondary	7,3...13,2 k Ω

Contact resistance	max. 0,3 Ω
Supply lines	
EI control unit/ primary circuit	

Temperature sensor - coolant	+	20° C	2,1...2,9	k Ω
	+	30° C	1,4...2,0	k Ω
	+	80° C	280...370	Ω
	+	90° C	210...280	Ω
	+	100° C	160...215	Ω

Spark-advance angle without vacuum
Engine at operating temperature, however
< 95° C

```
Trimming-plug setting "S" 25...29° BTDC
Trimming-plug setting "N" 19...23° BTDC
```

TEST SPECIFICATIONS (continued)

Trimming-plug setting
for version

	EIL *	EIL **
	ECE	CAT
* Color code: white	S	1 = infinity Ω
** Color code: green	2	2 = 2,4 k Ω
	N	3 = 1,3 k Ω
	4	5 = 750 Ω
	5	5 = 470 Ω
	6	N = 220 Ω
	7	7 = 0 Ω

Voltage supply	12...14 V
EI control unit and ignition coil with engine idling	max. 1 V below U _B

Throttle-valve switch -
idle contact

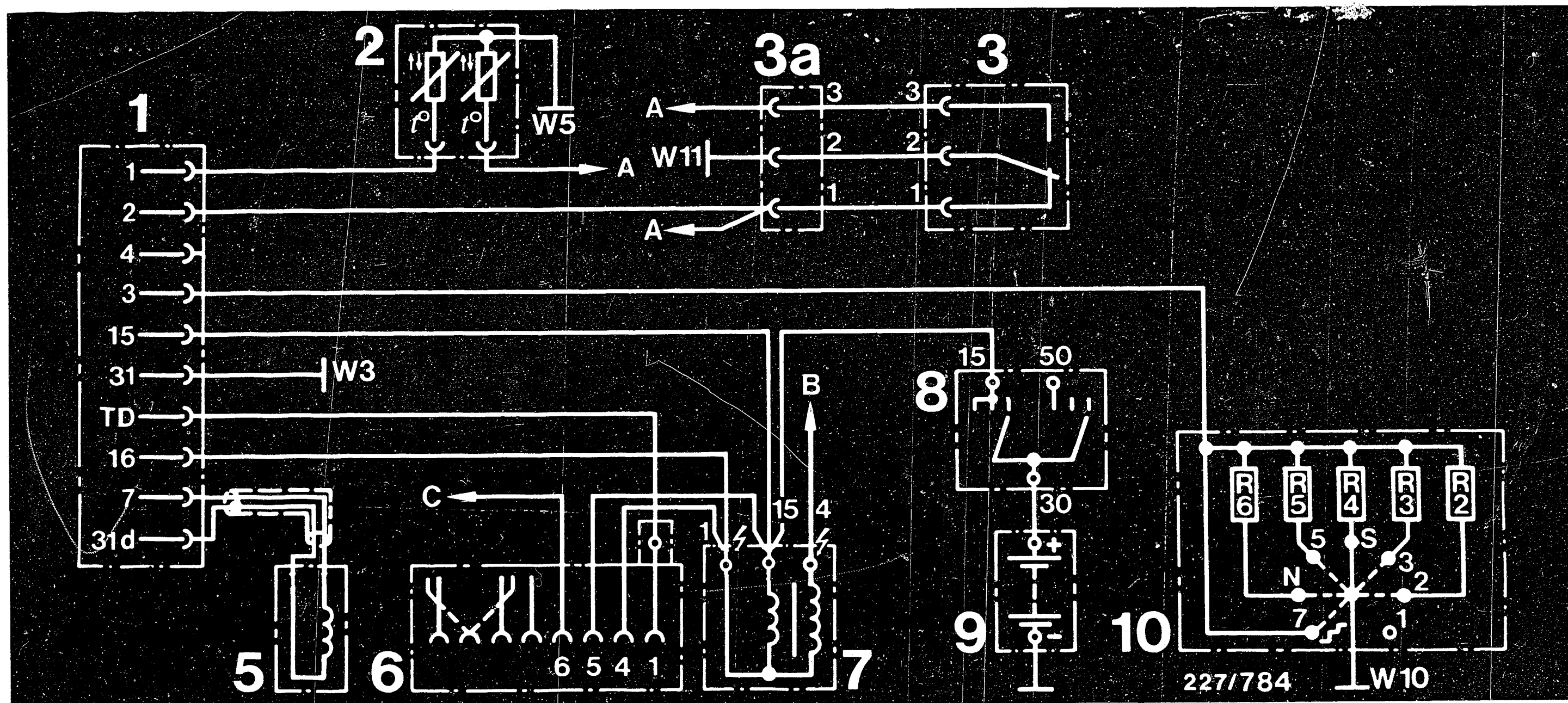
Idle position	app. 0 Ω (continuity)
Part-load position	infinity Ω

TEST SPECIFICATIONS (continued)

Peak-coil-current cutoff after approx. 1 s with ignition ON	0 V
Primary voltage with engine idling	280...360 V
Insulation, pulse generator	infinity Ω
Internal resistance Pulse generator	680...1200 Ω
Voltage, pulse generator at cranking speed	$U_s > 1 \text{ V}$
Voltage supply EI control unit with ignition ON	U_B
Voltage supply Primary circuit with ignition ON	U_B

Please refer to SIS microcard, KE-Jetronic and/or
Autodata test specifications for settings as regards
idling speed, exhaust emissions etc.

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coordinate.

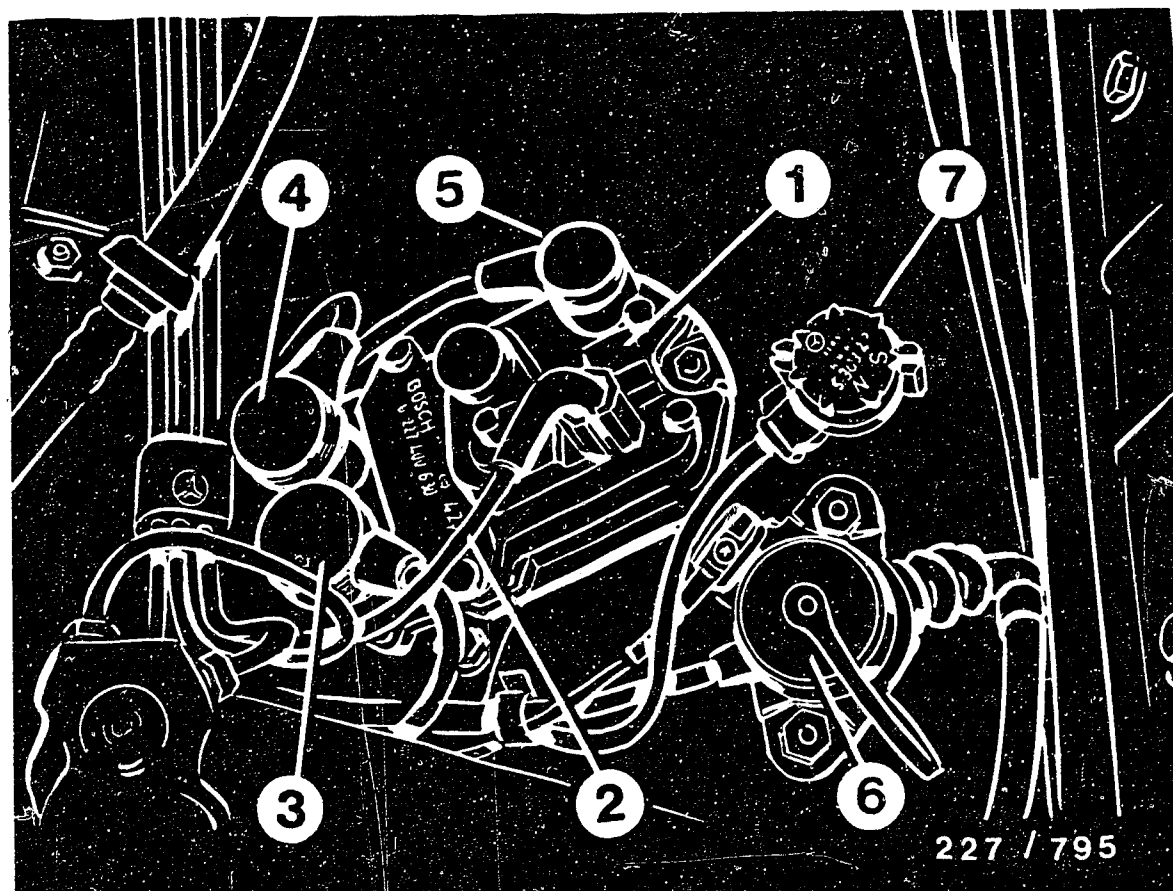


High-tension arrows: Caution, 400 V ... 25 kV

- 1 = EI control unit
- 2 = Temperature sensor - coolant (Twin NTC)
- 3 = Throttle-valve switch
- 3a = Plug connection, throttle-valve switch
- 5 = Pulse generator
- 6 = Diagnosis socket
- 7 = Ignition coil
- 8 = Ignition and starting switch

- 9 = Battery
10 = Trimming plug
 Labelling e.g. for EIL-CAT
A = To KE-Jetronic control unit
B = To high-tension distributor
C = To central-electrics console (Term. 30)
W3 = Ground, wheel house, front left
 (ignition coil)
W5 = Ground, engine
W10= Ground, battery
W11= Ground, engine (lead screwed
 on)

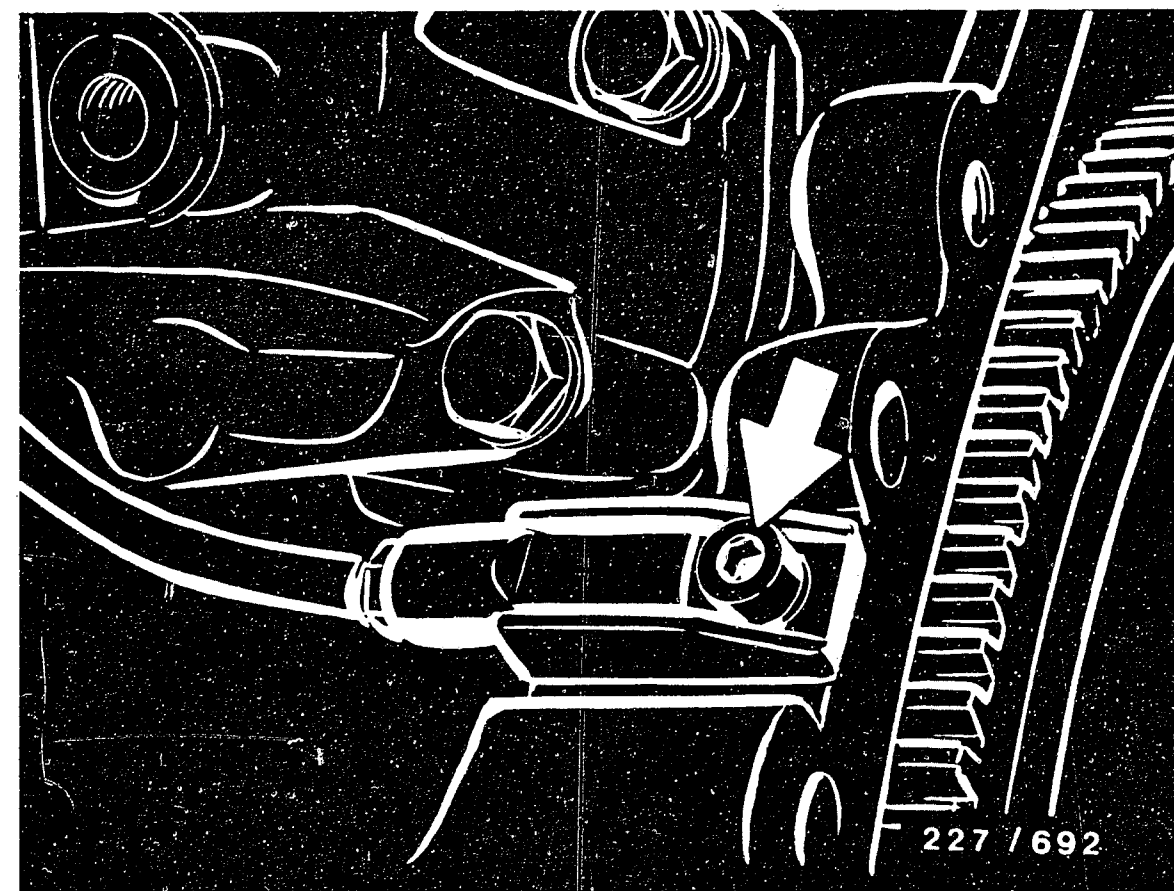
ELECTRICAL TERMINAL DIAGRAM



- 1 = EI control unit
- 2 = Vacuum hose
- 3 = Quadruple plug - supply
- 4 = Quadruple plug - sensor
- 5 = Coaxial plug - pulse generator
- 6 = Diagnosis socket
- 7 = Trimming plug - ignition

INSTALLATION POSITION OF COMPONENTS

The EI control unit and diagnosis socket are located on the left on the wheel house in the direction of travel.



Arrow = Pulse generator

INSTALLATION POSITION OF COMPONENTS (continued)

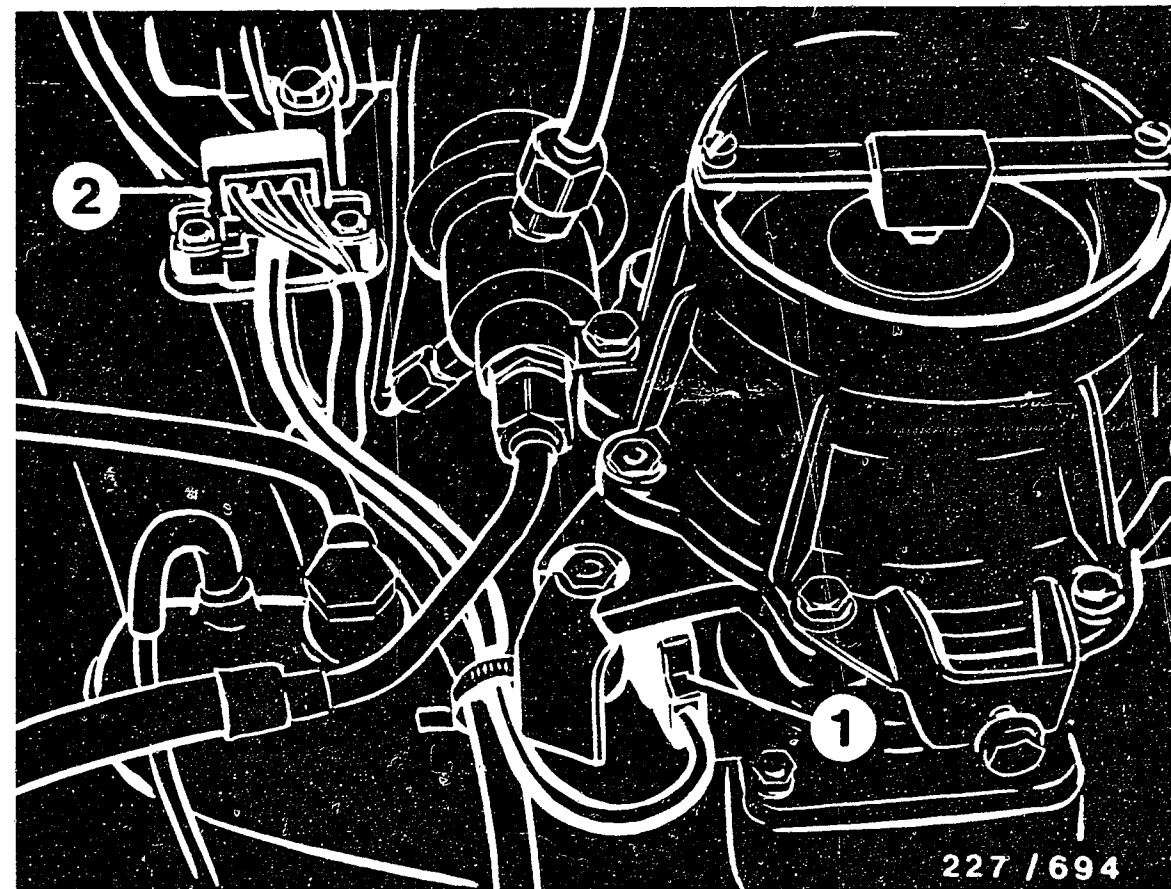
The pulse generator is located on the left on the engine block in the direction of travel.



Arrow = Coolant temperature sensor
(twin NTC)

INSTALLATION POSITION OF COMPONENTS (continued)

The coolant temperature sensor is located
on the side of the cylinder head.



1 = Throttle-valve switch
2 = Plug connection of throttle-valve switch

INSTALLATION POSITION OF COMPONENTS (continued)

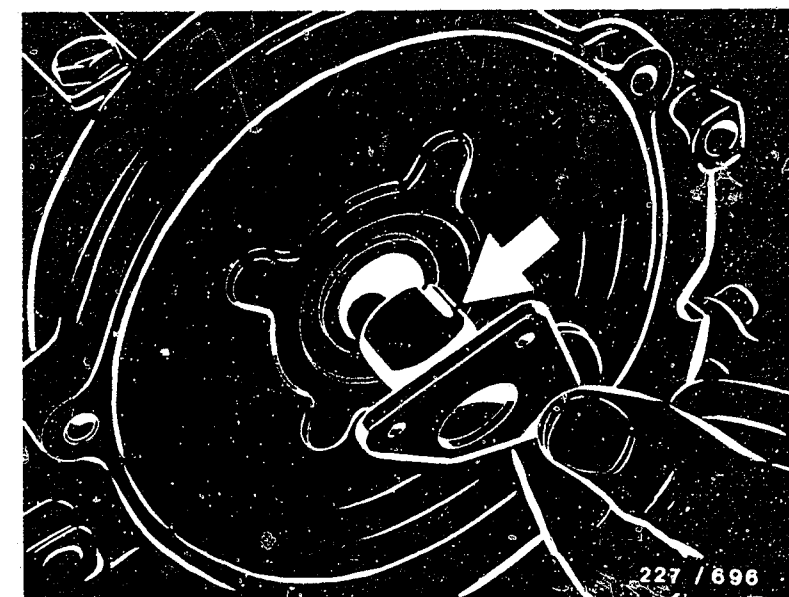
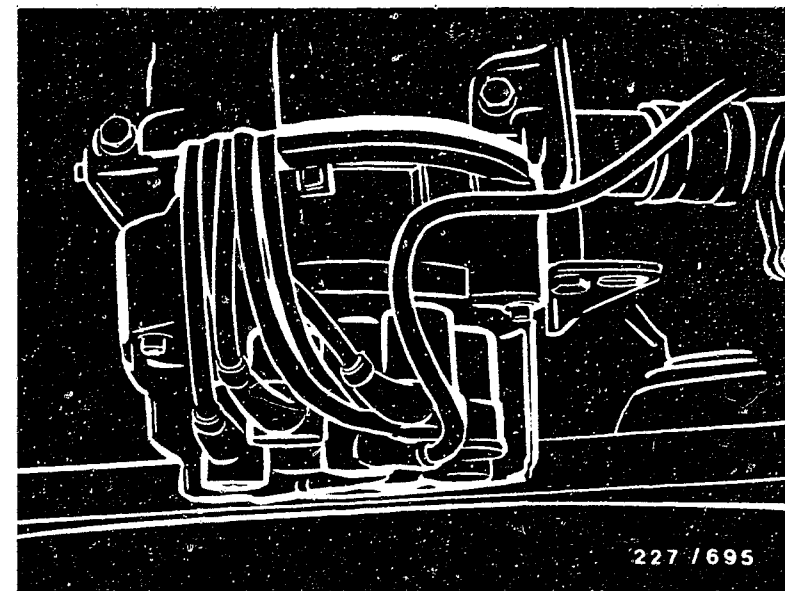
The throttle-valve switch is located on the
throttle-valve assembly.

INSTALLATION POSITION OF COMPONENTS (continued)

The high-tension distributor (see top picture) is attached to the front cover of the cylinder head and driven directly by the camshaft via the driver (see bottom picture, arrow).

The ignition cables at the distributor cap are to be fitted in the sequence 1, 3, 6, 2, 4, 5 (proper laying of ignition cables).

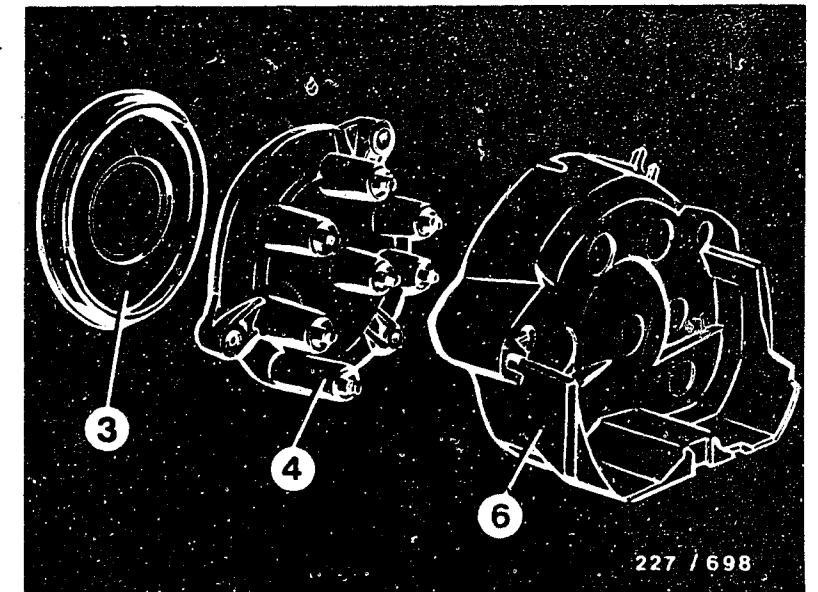
Please refer to next picture page for removal instructions.



INSTALLATION POSITIONS OF COMPONENTS (continued)

Removal instructions for high-tension distributor

Unclip cover on side (see top picture, arrows) and pull upwards.



Key to picture

- Item 1 = Fastening screws
- Item 2 = Distributor rotor
- Item 3 = Sealing disk
- Item 4 = Distributor cap
- Item 5 = Driver
- Item 6 = Screening cover

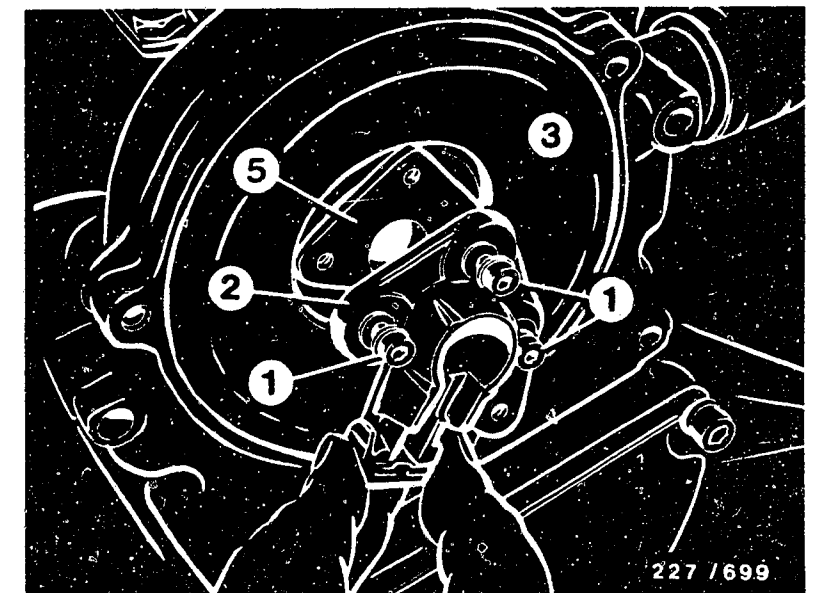


TABLE OF CONTENTS

Trouble-shooting instructions : BMW-5000

BOSCH system : Motronic

Make of vehicle : BMW

Basic microcard : BMW-509

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SPECIAL FEATURES

This microcard contains the test and repair instructions for the Motronic system in:

- * BMW 325 i (09.85 ->)
- * BMW 325 ix (4-wheel drive) (03.86 ->)
both with 2.5 l / 6-cyl. engine
without catalytic converter

New in these vehicles :

- Control unit No.0 261 200 073 :
ECE version.
- Control unit No.0 261 200 081 :
Version with "NO_x Control",
i.e. "limited low-pollution to Level B" (FRG-specific).
- Control unit No.0 261 200 083 :
Version for tropics.
- Knock-protection function in control unit.
- Low-idle-speed control from BOSCH with
temperature-dependent pilot control.

Important note:

If reference is made to a basic microcard, always make sure you use the test specifications from the vehicle-specific brief instructions.

RAPID DIAGNOSIS CHART TO UNIVERSAL TEST ADAPTER

The following rapid diagnosis chart makes it possible for the experienced Motronic expert to quickly check the electrical part of the system using the universal test adapter.

The rapid diagnosis chart contains the following information:

- * Sequence of test steps.
- * Position of V and Ω program-selector switches.
- * Notes on how to operate the universal test adapter or other components.
- * Test specifications for motortester and multimeter.

For production reasons:
continued on the following
coordinate.

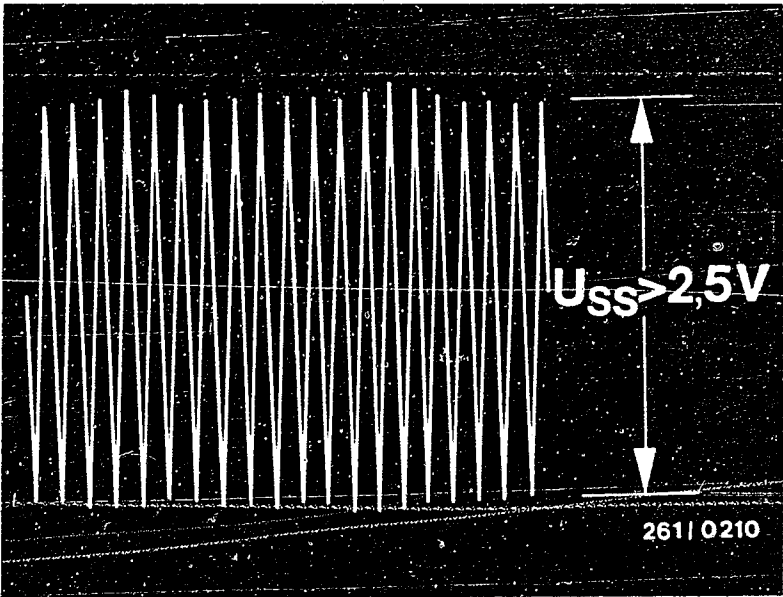
RAPID DIAGNOSIS CHART TO UNIVERSAL TEST ADAPTER (CONTINUATION)

Valid for control units 0 261 200 073, .. 081, .. 083

Test step	Switch position V	Ω	Measurement	Measurement at control-unit plug between term.	Remarks	Test specifications (reading)
1	↓ V	1	Insulation resistance of speed sensor.	8 <==> 5	Shift gear to neutral. Ignition off. Disconnect Motronic control unit and pump relay. Likewise disconnect transmission control unit (if present) or disconnect multiple plug in area of glove compartment.	greater than 1 M Ω
2	↓ V	2	Insulation resistance of reference-mark sensor.	25 <==> 5	—	greater than 1 M Ω
3	↓ V	3	Winding resistance of speed sensor.	8 <==> 27	—	0,6...1,6 k Ω
4	↓ V	4	Winding resistance of reference-mark sensor.	25 <==> 26	—	0,6...1,6 k Ω
5	↓ V	5	Resistance of temperature sensor, engine (NTC II).	13 <==> 5	Resistance temperature-dependent: (+ 15° C...+ 30° C) : (+ 80° C) :	1,45...3,3 k Ω 280...360 Ω
6	↓ V	6	Resistance of temperature sensor, air (NTC I).	22 <==> 5	Resistance temperature-dependent: (+ 15° C...+ 30° C) :	1,45...3,3 k Ω
7	↓ V	7	Transmission mesh switch (if electronically controlled transmission shift present) or term. 10 open.	10 <==> 5	Electronically controlled transmission shift : Manually-shifted transmission and automatic :	greater than 1 M Ω greater than 1 M Ω
8	↓ V	8	Not applicable	29 <==> 5	—	—
9	↓ V	9	Throttle-valve switch: Resistance of idle contact.	2 <==> 5	Accelerator in off-position : Slightly open throttle valve:	smaller 10 Ω greater 1 M Ω

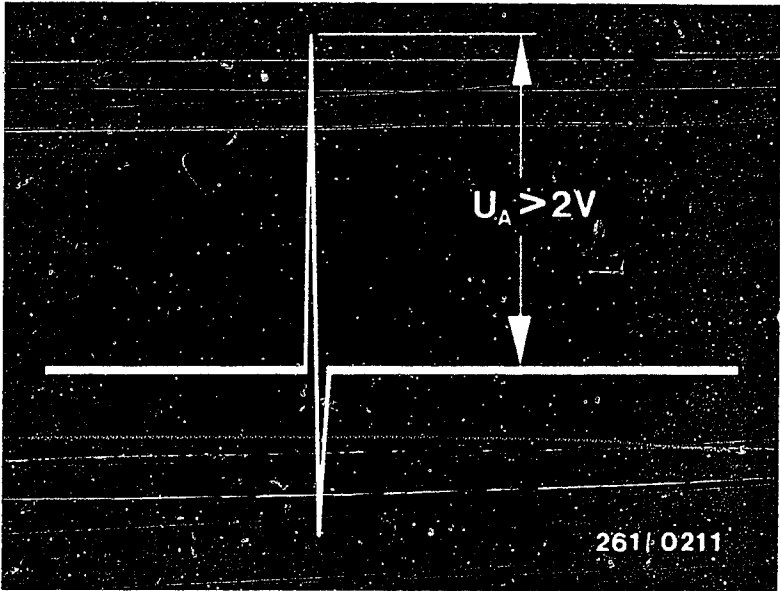
RAPID DIAGNOSIS CHART TO UNIVERSAL TEST ADAPTER (CONTINUATION)

Test step	Switch position V	Ω	Measurment and remarks	Measurment at control-unit plug between term.	Test specifications (reading)
10	V	10	Throttle-valve switch: Resistance of full-load contact. Fully depress accelerator:	3 \longleftrightarrow 5	smaller than 10 Ω
11	V	11	Resistance of ground cable	16 \longleftrightarrow 5	sm. than 10 Ω
12	V	12	Resistance of ground cable	17 \longleftrightarrow 5	sm. than 10 Ω
13	V	13	Resistance of ground cable	19 \longleftrightarrow 5	sm. than 10 Ω
14	V	14	Not applicable	30 \longleftrightarrow 5	—
15	V	15	Resistance of driving-position switch (for automatic and electronically controlled transmission shift). For manually-shifted transmission term. 28 to ground:	28 \longleftrightarrow 5	Position switch in position P, N : smaller than 10 Ω In position 1, 2, 3, D, R : greater than 1M Ω sm. than 10 Ω
16	1	15	Speed-sensor oscilloscope. Shift gear to neutral and start.	8 \longleftrightarrow 27	See upper illustration
17	2	15	Reference-mark sensor signal with oscilloscope. Shift gear to neutral and start.	25 \longleftrightarrow 26	See lower illustration



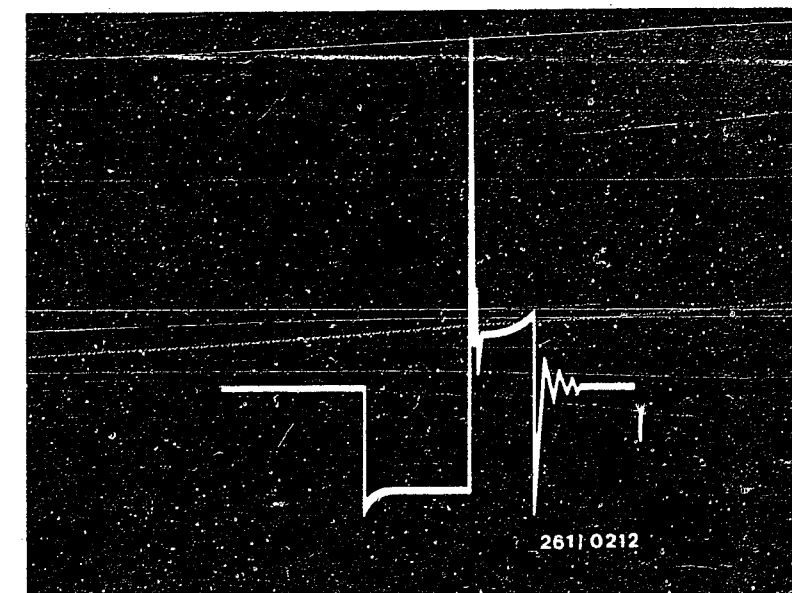
Speed-sensor signal

Reference-mark sensor signal. Positive peak must come first.



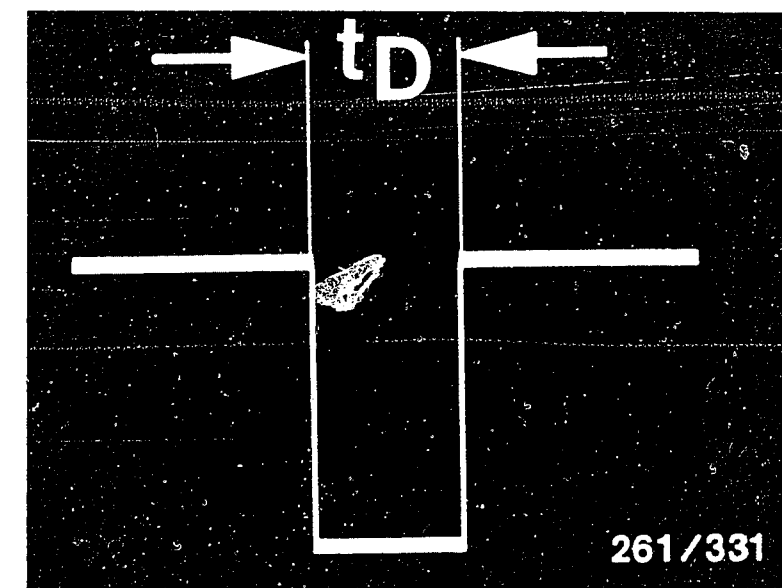
RAPID DIAGNOSIS CHART TO UNIVERSAL TEST ADAPTER (CONTINUATION)

Test step	Switch position V	Ω	Measurement and remarks	Measurement at control-unit plug between term.	Test specifications (reading)
18	3	15	Not applicable	10 \longleftrightarrow 5	
19	4	15	Voltage at air conditioner (if present). Switch on air conditioner.	29 \longleftrightarrow 5	greater than 8 V
20	6	15	Voltage of main relay. Ignition on.	35 \longleftrightarrow 5	10...15 V
21	7	15	Not applicable	18 \longleftrightarrow 5	
22	5	15	Ignition signal of ignition coil with oscilloscope. Ignition off. Connect control unit. Shift gear to neutral and start.	1 \longleftrightarrow 5	Signal present (see upper illustration)
23	8	15	Supply voltage for air-flow sensor. Ignition on.	9 \longleftrightarrow 5	greater than 4,5 V
24	9	15	Wiper voltage of potentiometer in air-flow sensor. Ignition on.	7 \longleftrightarrow 5	Air-flow sensor flap in off-pos. 200...300 mV Air-flow sensor fl. compl. open: greater than 4,2 V
25	10	15	Not applicable	32 \longleftrightarrow 5	
26	11	15	Not applicable	28 \longleftrightarrow 5	
27	12	15	Start signal from term. 50 Shift gear to neutral and start.	4 \longleftrightarrow 5	8...15 V
28	13	15	Dwell-period signal with oscilloscope. Shift gear to neutral and start.	21 \longleftrightarrow 5	See lower illustration



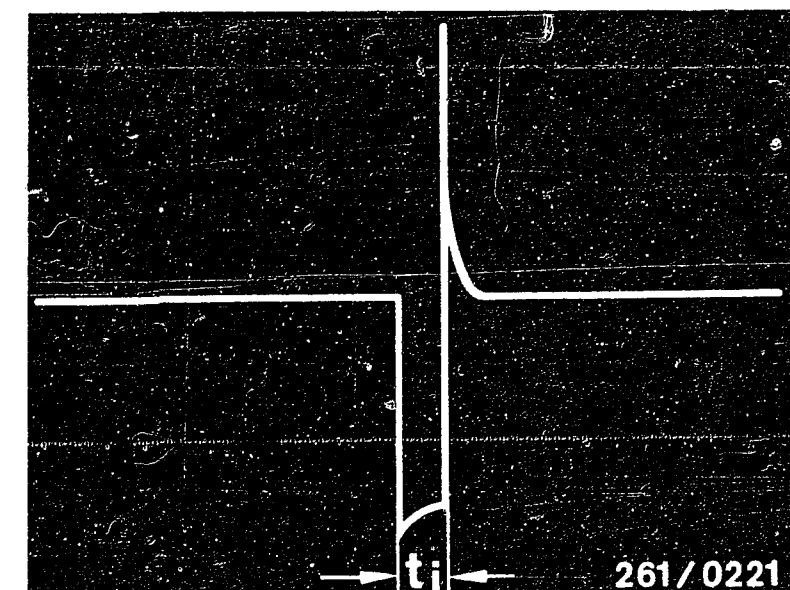
Ignition signal (prim. sig.)

Dwell-period signal.
 t_D = Dwell period



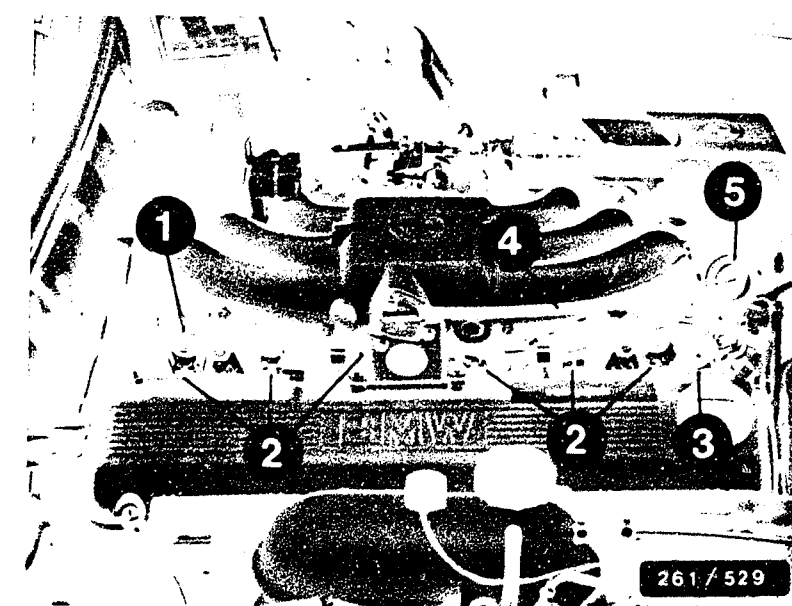
RAPID DIAGNOSIS CHART TO UNIVERSAL TESR ADAPTER (CONTINUATION)

Test step	Switch position V	Ω	But ton	Measurment and remarks	Measurement at control-unit plug between term.	Test specifications (reading)
29	14	15	—	Injection signal from control unit with oscilloscope. Shift gear to neutral and start.	14 \longleftrightarrow 5	See upper illustration
30	14	15	T1	As Test step 29, however, after pressing button (NTC II, cold), duration of injection becomes slightly longer. Press button only approx. 2 seconds.	14 \longleftrightarrow 5	See upper illustration; t_i becomes slightly wider
31	15	15	—	As Test step 29, however, 2nd output for injection valves	15 \longleftrightarrow 5	See upper illustration
32	16	15	—	Injection signal from control unit with oscilloscope (measuring output). Shift gear to neutral and start.	11 \longleftrightarrow 5	See upper illustration
33	17	15	—	Voltage at pump relay. Connect pump fuse. Ignition on.	20 \longleftrightarrow 5	10...15 V
34	17	15	—	Voltage at pump relay. Pump control in control unit is tested. Shift gear to neutral and start.	20 \longleftrightarrow 5	max. 4 V
35	17	15	T3	Fuel-pressure test: Ignition off. Connect pressure gauge at test connection. Ignition on. Press button T3.	20 to ground	2,8...3,2 bar



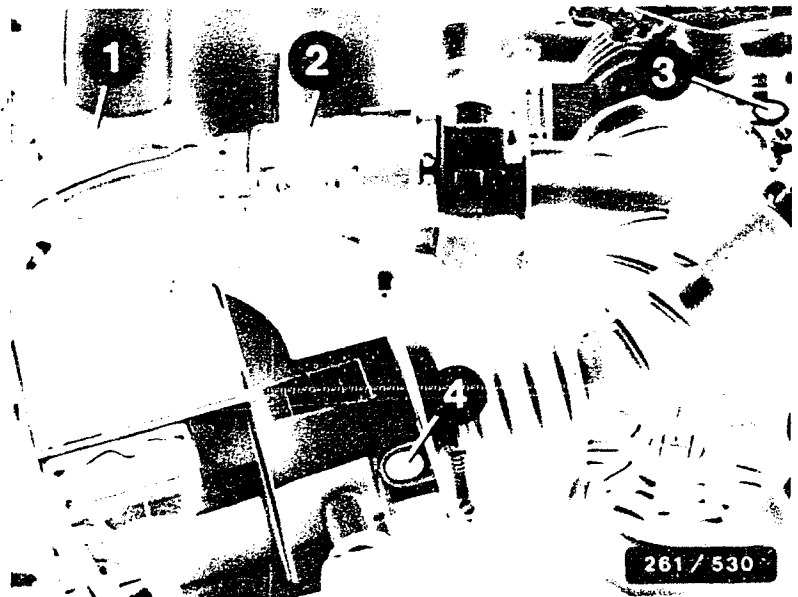
Injection signal
 t_i = Duration of injection

- 1 = Test connection at fuel-distrib. pipe (supply)
- 2 = Solenoid-op. inj. valves
- 3 = NTC II
- 4 = Air hose to intake manif.
- 5 = Fuel-pressure regulator



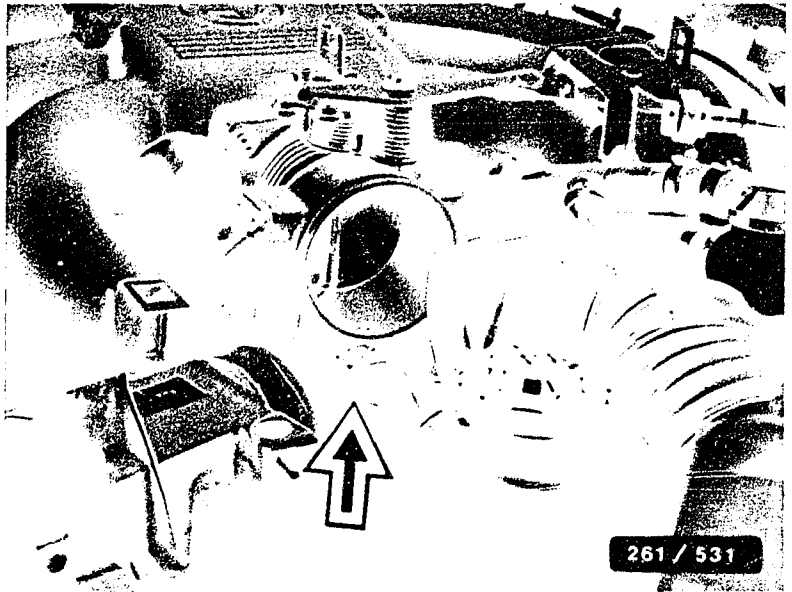
RAPID DIAGNOSIS CHART TO UNIVERSAL TEST ADAPTER (CONINUATION)

Test step	Switch position V	Btn Ω	Measurement and remarks	Measurement at control-unit plug between term.	Test specifications (reading)
36	17	15	<p>Test CO and idle speed: Connect motortester, CO tester and diagnosis cable (1 684 463 122).</p> <p>First measure CO. Engine at normal operating temperature, all consuming devices switched off.</p>	—	<p>0,5...1,5 % by vol. CO</p> <p>735...785 min -1</p>
		T5 and T6	<p>For testing the idle-speed <u>basic</u> setting, simultaneously press buttons T5 and T6 of the universal test adapter or use KDZS 0003 for simultaneous short-circuiting of the LL contact and VL contact. Read off test specification and if necessary, adjust idle speed at the LL adjustment screw.</p>		<p>710...760 min -1</p>
37	17	15	<p>Spark advance at idle speed. Run engine at normal operating temperature with idle speed (735 ... 785 min -1).</p> <p>Speed must be correct, otherwise incorrect spark advance is indicated. Note: no ignition marking, use diagnosis cable 1 684 463 122.</p>	—	5°...15° ° crank
38	17	15	<p>Test spark advance at full load: engine at normal operating temperature. Set speed to 2500 min -1 . Press button T6.</p>	3 to ground	25°...35° ° crank at 2500 min -1



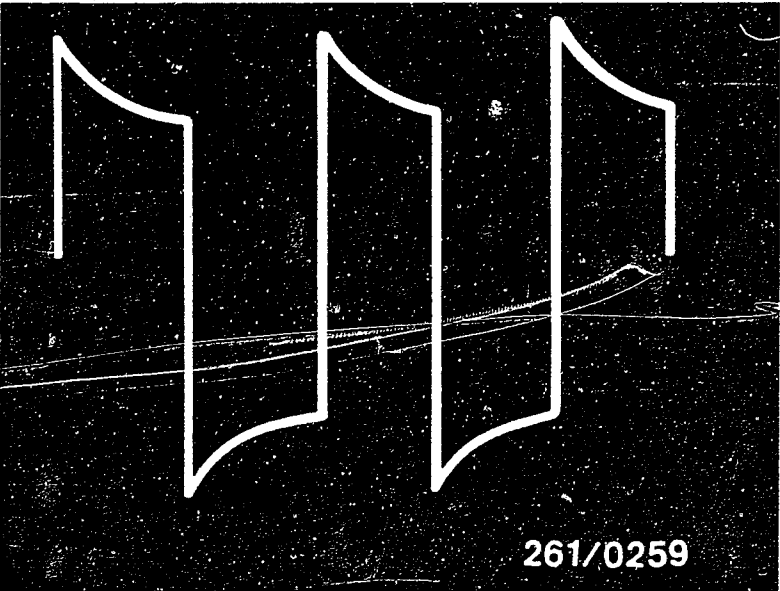
- 1 = BMW diagnosis connection (for diagnosis cable 1 684 463 122)
- 2 = Idle actuator
- 3 = LL adjustment screw
- 4 = CO adjustment screw

Arrow = Throttle-valve switch



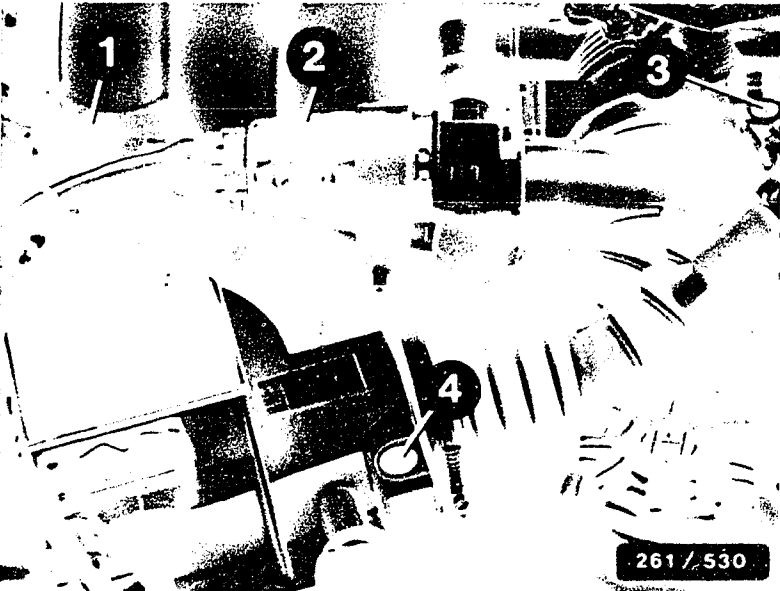
RAPID DIAGNOSIS CHART TO UNIVERSAL TEST ADAPTER (CONTINUATION)

Test step	Switch position V Ω		Btn	Measurement and remarks	Measurement at control-unit plug between term.	Test specifications (reading)
39	17	15	—	Dwell angle at idle speed	——	6°...18°
				Dwell angle at 3000 min ⁻¹	——	25°...45°
40	17	15	T5	Test overrun cutoff: keep speed of 2000 min ⁻¹ constant. Press button T5. Injection signals interrupted and speed fluctuates rythmically.	2 to ground	Engine "hunts"
41	18	15	T5 and T6	On-off ratio at idle actuator with dwell-angle tester (% scale). Clip 15 of motortester to red trough. Engine at normal operating temperature runs at idle. With buttons T5 and T6 pressed, speed should be 710...760 min ⁻¹ (if nec., adjust, see lower illustration).	33 <==> 5	62...72 % Signal shape, see upper illustration (Oscilloscope, special input)
42	19	15	T5 and T6	As Test step 41, however, measurement at second winding of idle actuator.	34 <==> 5	28...38 % Signal shape, as above



Signals at idle actuator

- 2 = Idle actuator
- 3 = LL adjustment screw



TEST SPECIFICATIONS

Pressure regulator
Fuel pressure

2,8...3,2 bar

Electric fuel pump

Fuel delivery
(measured in return)
Connection voltage
(under load):

at least 800 cm³ /30s

at least 12 V

Temperature sensor, air (NTC I)

Internal electrical resistance
measured at air-flow sensor
between term. 1 and term. 4
at ambient temperature
(+15°C...+30°C):

1,45...3,3 k Ω

Temperature sensor, engine (NTC II)

Color of plug, blue.

Internal electrical resistance

at ambient temperature
(+ 15° C...+ 30° C):

1,45...3,3 k Ω

engine at normal operating temperature
(approx. + 80° C):

280...360 Ω

Solenoid-operated injection valve

Internal electrical resistance

at ambient temperature
(+ 15° C...+ 30° C):

15...17,5 Ω

Air-flow sensor

Internal electrical resistance between:

Term.2 and term.4 : 8...2500 Ω (*)

Term.3 and term.4 : 500...1100 Ω

(*) Deflect air-flow sensor flap as far as will go.

K17

TEST SPECIFICATIONS (CONTINUATION)

Speed sensor and reference-mark sensor

Internal electrical resistance
at ambient temperature
(+15°C...+30°C):

0,6...1,6 k Ω

Throttle-valve switch

Resistance value of idle
contact (term. 2 / ground):

0 Ω

Resistance value of full-load
contact (term. 3 / ground):

0 Ω

For vehicle with controlled transmission shift.
(6-pin connection):

Resistance value of idle
contact (term. 4 / term. 6):

0 Ω

Resistance value of full-load
contact (term. 4 / term. 5):

0 Ω

Idle actuator

Internal electrical resistance
at +15°...+30°C

Term.3 and term.2 :

17...22,5 Ω

Term.1 and term.2 :

19...25 Ω

Low-idle-speed control.

Engine at normal operating temperature,
ambient temperature +15°...+30°C.

Switch off consuming devices.

Idle speed:

735...785 min⁻¹

CO concentration:

0,5...1,5 % by vol. CO

See equipment and Autodata microcard for settings for
valve clearance and other engine data.

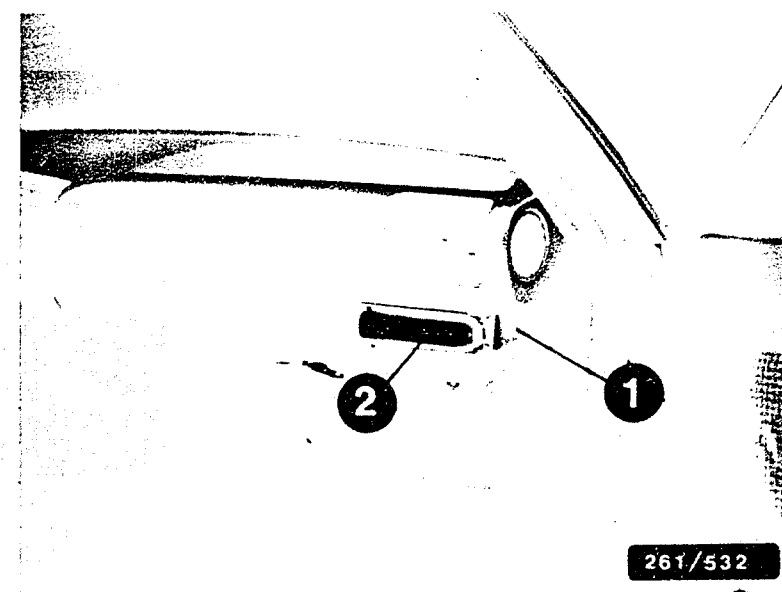
K18

INSTALLATION POSITION OF COMPONENTS

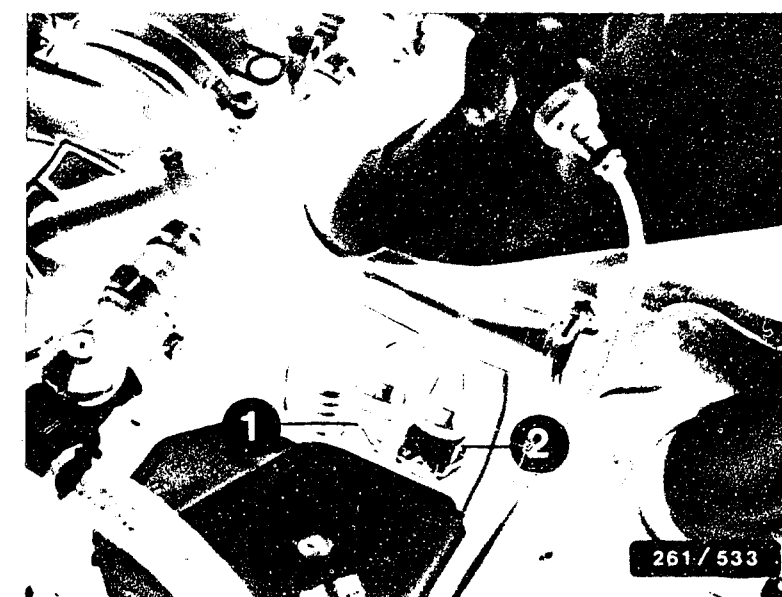
The indications "right" and "left" always refer to the forward direction of travel.

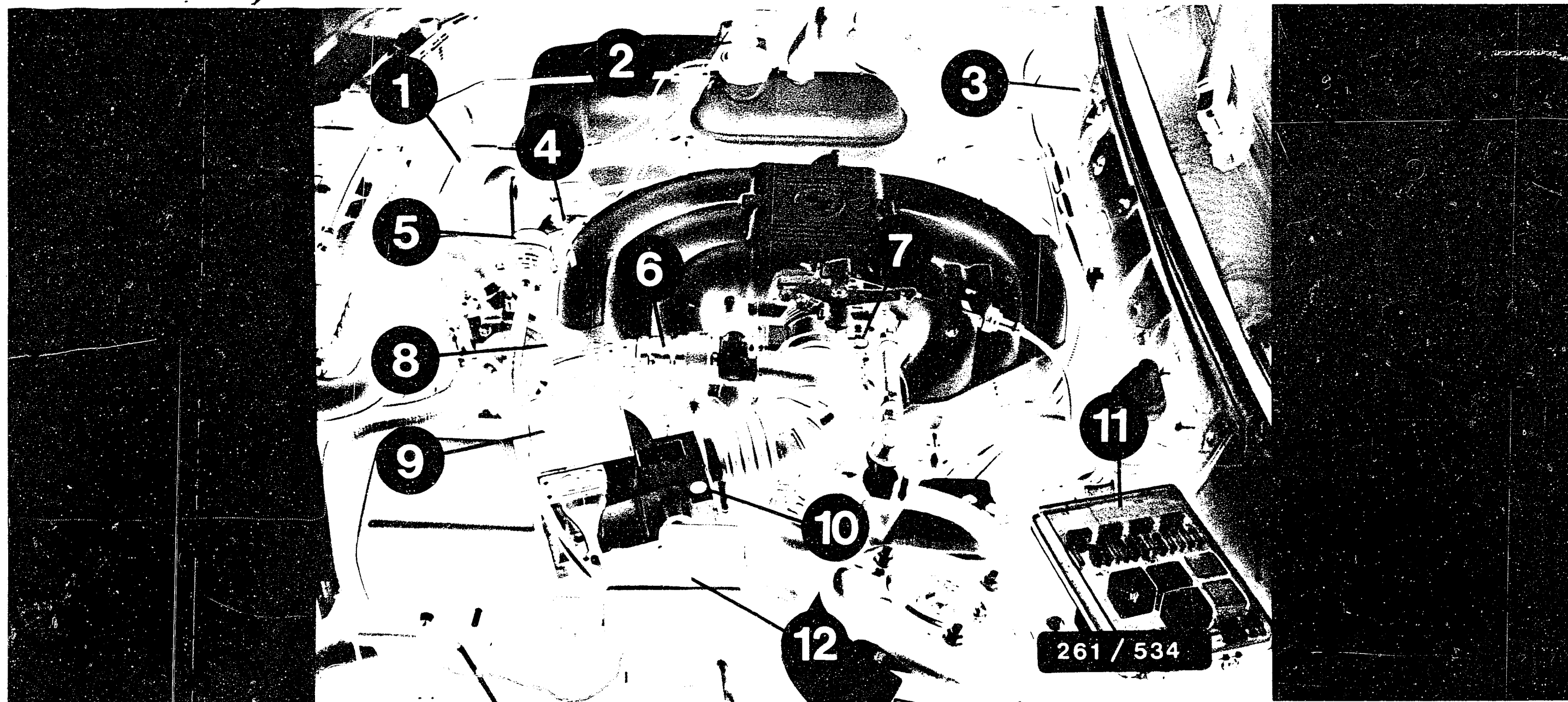
Components are listed below, which are not visible in the illustration.

- * Speed sensor and reference-mark sensor:
In the starting-motor ring-gear bell at circumference of flywheel ring gear.
- * Fuel filter:
In engine compartment at left, near to firewall.
- * Fuel pump:
Under the vehicle, near to fuel tank.
- * Ground cable of electric fuel pump:
Under the rear seat bench, at left (trough), ground point at body.
- * Control unit:
In glove compartment behind the cover (see upper illustration).
- * Temperature sensor, air (NTC I):
In air-flow sensor.
- * Central ground:
At intake manifold pipe of 5th cylinder.
- * Throttle-valve switch:
At bottom of throttle-valve assembly.
- * Battery:
In trunk at right, under the cover.
- * Connectors for speed sensor and reference-mark sensor:
At engine block at left (see lower illustration).



1 = Control unit
2 = 35-pin plug

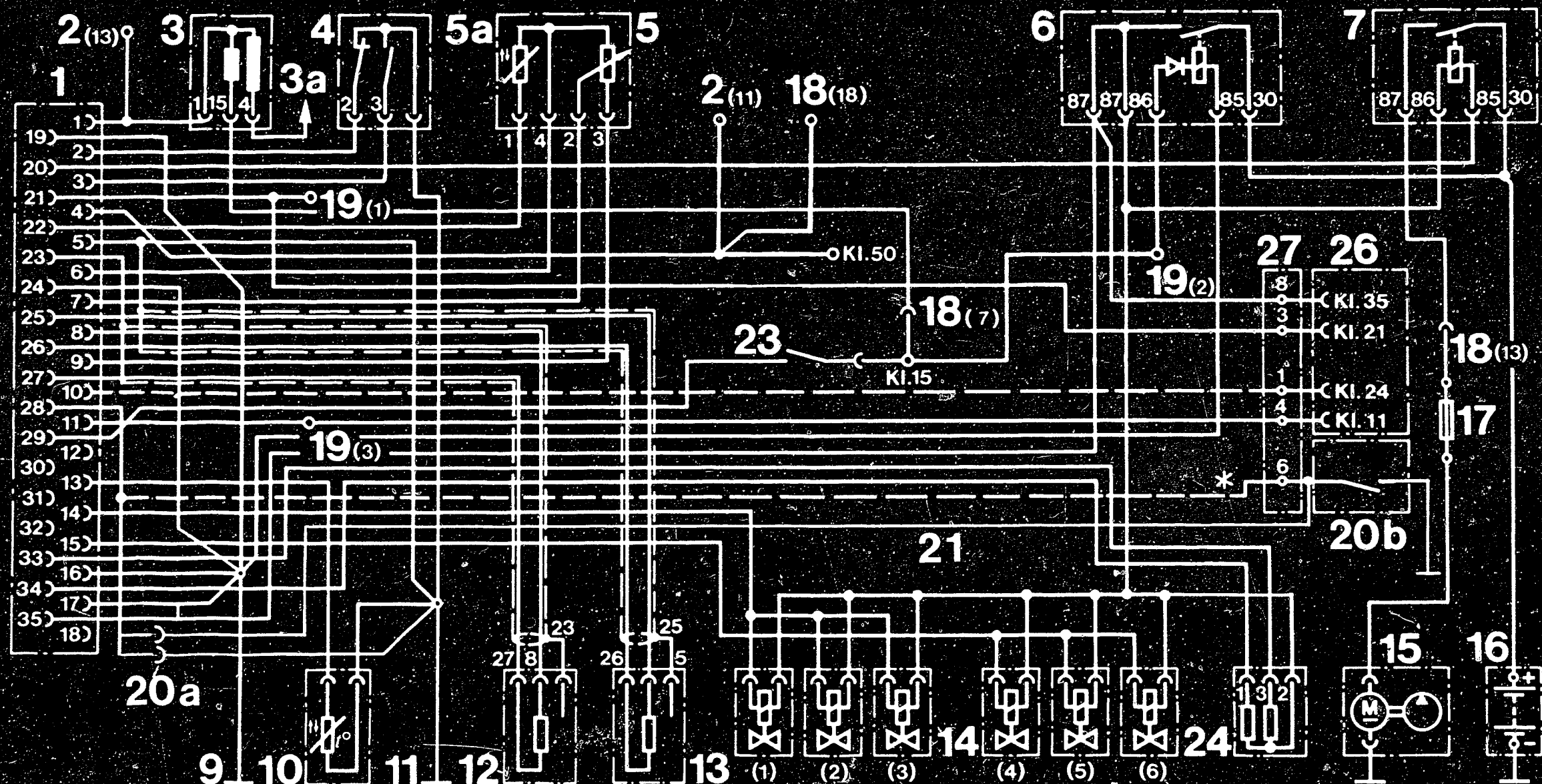




- 1 = High-voltage distributor
- 2 = Ignition coil
- 3 = Positive battery connection
- 4 = Temperature sensor, engine (NTC II)
- 5 = Pressure regulator
- 6 = Idle actuator

- 7 = Idle adjustment screw
- 8 = Diagnosis socket outlet
- 9 = Air-flow sensor
- 10 = CO adjustment screw
- 11 = Electrics box
- 12 = Cover for main relay and pump relay

INSTALLATION POSITION OF COMPONENTS (CONTINUED)



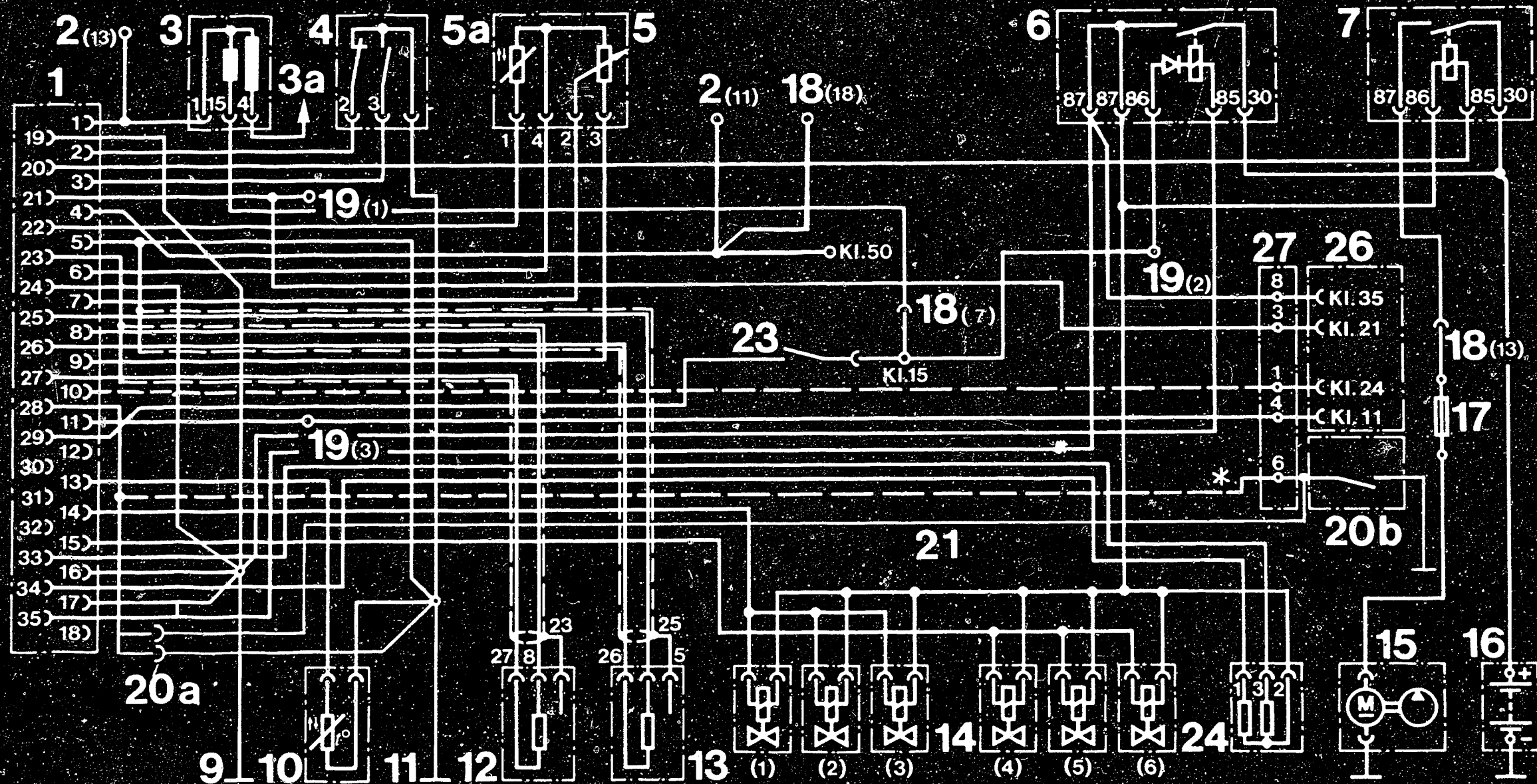
261/528

- 1 = Motronic control-unit plug
- 2 = Diagnosis plug (No. 11, 13)
- 3 = Ignition coil
- 3a = to high-voltage distributor
- 4 = Throttle-valve switch (with potentiometer for vehicles with elec. controlled transm. shift)

- 5 = Air-flow sensor
- 5a = Temperature sensor I (air)
- 6 = Relay 2 (main relay with reversed-polarity protection diode)
- 7 = Relay 1 (pump relay)
- 9 = Vehicle ground for control-unit output stage

- 10 = Temperature sensor (coolant)
- 11 = Vehicle ground for control unit
- 12 = Speed sensor
- 13 = Reference-mark sensor
- 14 = Injection valves

ELECTRICAL TERMINAL DIAGRAM



261/528

- 15 = Fuel pump
- 16 = Battery
- 17 = Pump fuse
- 18 = Engine plug (No.7, 13, 18)
- 19 = Plug connection
(in glove compartment)

20a = Automatic and elec. controlled
transmission shift:
Plug connection disconnected.
Manually-shifted transmission:
Plug connection connected
(term. 28 to ground)

- 20b = Automatic and electronically
controlled transmission shift:
In position P and N to ground
In position D, 1, 2, 3, R, open
- 21 = Lead only for automatic
- 23 = Switch at air-conditioner compressor
- 24 = Idle actuator
- 26 = Control unit of elec. controlled
transmission shift (if present)
- 27 = Multiple plug in glove compartment
(only with elec. controlled trans. shift)
- * = dashed lines only for vehicle with
elec. controlled transmission shift

ELECTRICAL TERMINAL DIAGRAM (CONTINUATION)

Always pay attention to SAFETY AND PRECAUTIONARY MEASURES in order to avoid damage to the engine, control unit or ignition coil, as well as to prevent danger to persons.

1. CAUTION!

High-output ignition system with dangerous high and low voltages!

Contact with components or terminals under voltage may be dangerous (both at the primary and secondary ends).

2. When testing the compression, disconnect the Motronic relay. In this way, undesired injection by the injection valves is avoided.

3. Never start engine when battery not firmly connected.

4. Incorrect polarity of the supply voltage, e.g. through incorrect connection of the battery or ignition coil, may lead to the destruction of the control unit.

5. Never use a fast charger for starting the engine. Provide starting aid only using a second 12 V battery and jump leads.
Caution! Due to non-uniform demands of the vehicle manufacturer made on electronic products, we recommend that a 24 V battery never be used for providing starting aid. Observe the vehicle owner's manual.

6. Disconnect the battery from the vehicle electrical system before boost charging.

7. When charging the battery in the vehicle or providing starting aid, observe the instructions in the operating manual of the fast charger, as well as the instructions from the vehicle manufacturer.

8. Never disconnect the battery from the vehicle electrical system when the engine is running.

9. Never short circuit ignition coil term. 1 to ground (e.g. for switching off the engine). Ignition coil and, under certain circumstances, control unit are destroyed.

10. Never connect the positive battery terminal to ignition coil term. 1. Control unit is destroyed.

11. Never disconnect or connect wiring-harness plug of control unit when ignition is switched on.

12. When temperatures are above +80°C (drying oven), the control unit must be removed.

13. When welding (electric spot welding), the control unit must be removed.

14. When installing an alarm system, observe the installation instructions for Motronic vehicles or the SIS microcard ALL-500.
Make sure that the alarm relay is not destroyed by external fields (e.g. from ignition cables) so that it responds in a defective manner.

Brief instructions : MB-5036

BOSCH system : Electronic ignition (EI)

Make of vehicle : MERCEDES-BENZ

Basic microcard : PKW-059

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SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Mercedes-Benz Model:

260 E , with 2.6 l / 6 cyl.
engine 103.940 9.86 ->
USA, Japan, Australia.

* EI control unit 0 227 400 583
(with current limitation)

* Ignition coil 0 221 5..

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

How to use rapid diagnosis chart

Use is to be made of rapid diagnosis chart as of coordinate 07 , if primary signal/ignition spark is present.

Use is to be made of rapid diagnosis chart as of coordinate 11 , if there is no primary signal/ignition spark.

TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems
(Engine speed, exhaust gas).
4. Poor throttle take-up,
flat spot during acceleration.
5. Engine missing
(Ignition, injection).
6. Maximum engine power/
top speed not reached.
7. Fuel consumption too high.
8. Engine running on.
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

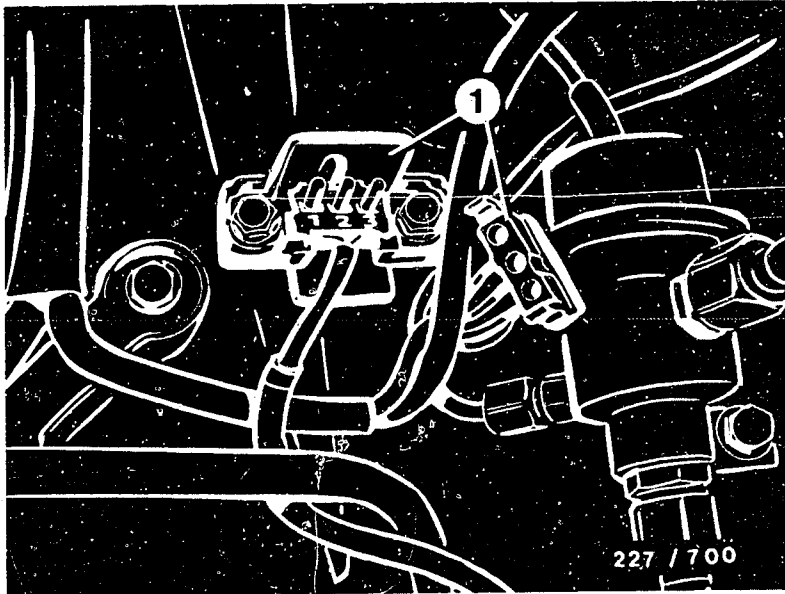
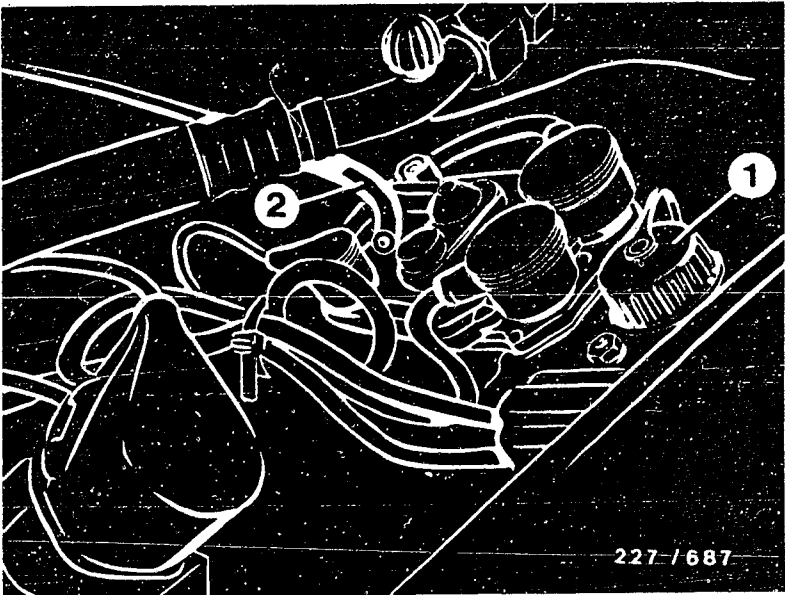
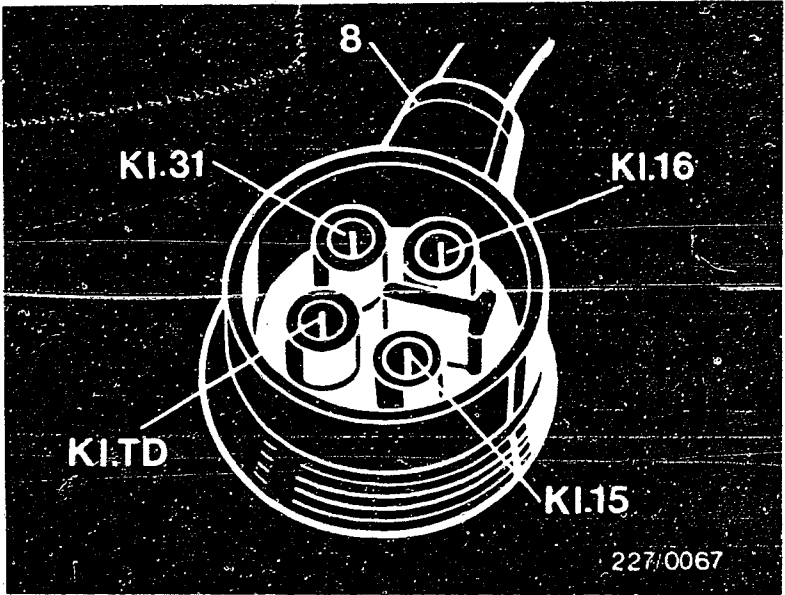
						Cause (Component fault)
*						Peak-coil-current cutoff
		*				Primary voltage
*						Insulation, pulse generator
*						Internal resistance, pulse generator
*						Voltage, pulse generator
*						Voltage, EI control unit
*						Voltage, primary circuit

For production reasons:
continued on the following
coordinate.

RAPID DIAGNOSIS CHART
Primary signal/ignition spark present

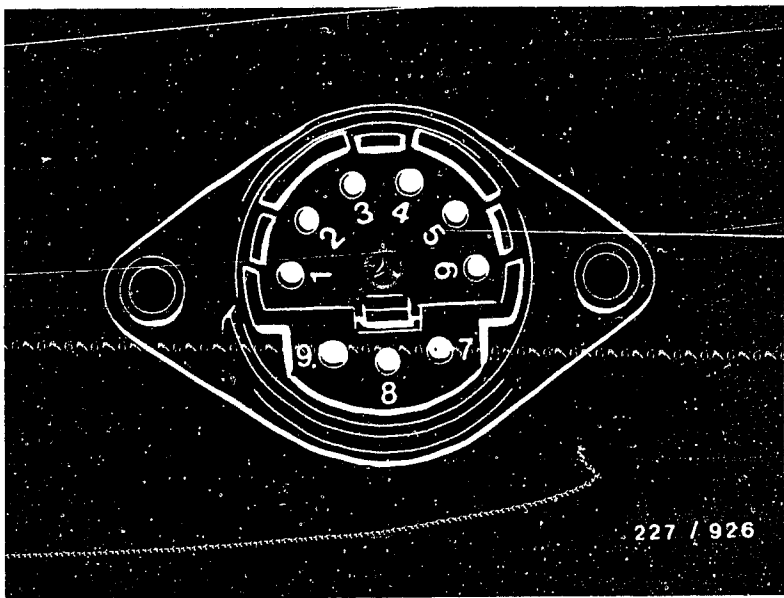
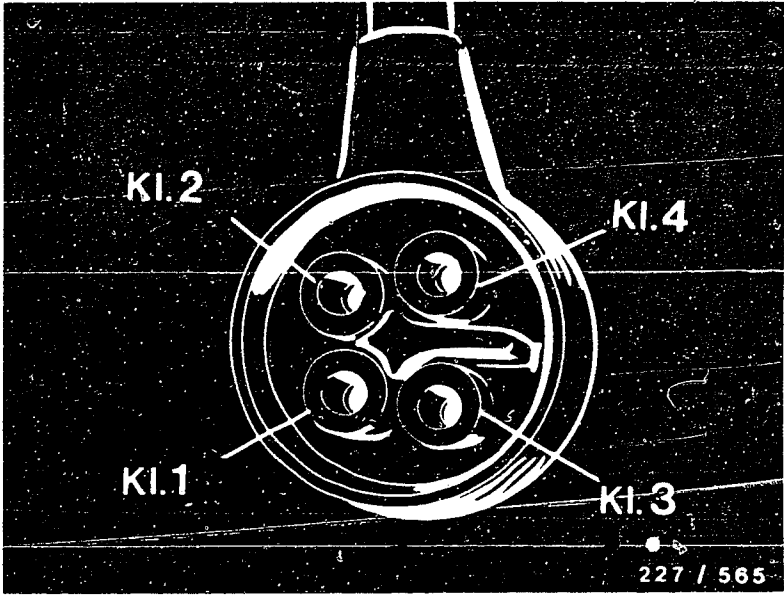
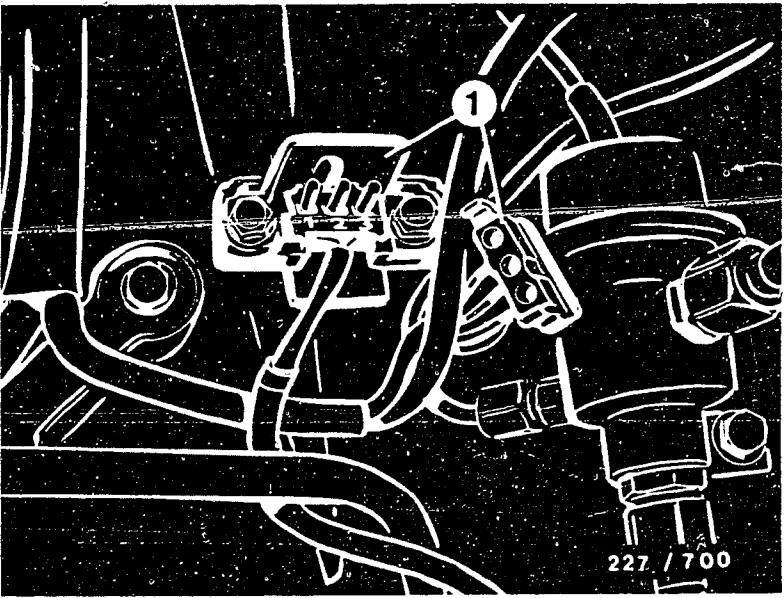
Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
1	HIGH-TENSION SIDE Check functioning (e.g. open-circuit, shunt) of for example spark plugs, ignition harness and distributor cap. Assessment for example by way of ignition oscillogram, resistance measurement, visual inspection.	—	—
2	IGNITION COIL Primary resistance Secondary resistance	1 15 1 4	0,3... 0,6 Ω 7,3...12,2 k Ω
3 *	CONTACT RESISTANCES (primary side) Disconnect - and + leads from battery. Ignition ON. Resistance from battery terminal to EI control-unit plug. See top picture. Resistance from battery terminal to ignition coil. Resistance from EI control-unit plug to ignition coil.	B+ 15 B- 31 B+ 15 16 1	max. 0.3 Ω max. 0.3 Ω
4	PRESSURE SENSOR Detach vacuum hose, EI control unit. See center picture, item 2. Disconnect plug connection of throttle-valve switch. See bottom picture. Engine at idle. Read off spark-advance angle. Attach vacuum hose, EI control unit.	—	ADVANCE spark-advance angle
5	TEMPERATURE SENSOR - COOLANT Engine at operating temperature. Detach vacuum hose, EI control unit. See center picture, Item 2. Detach plug connection of throttle-valve switch. See bottom picture Engine at idle. Read off spark-advance angle. Detach temperature-sensor plug (not illustrated).	—	Change in spark-advance angle

* Perform only with engine not running.



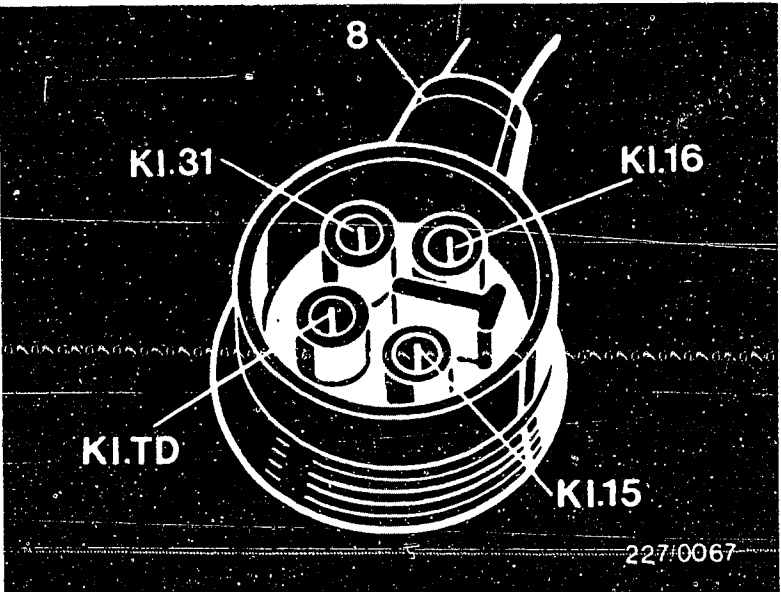
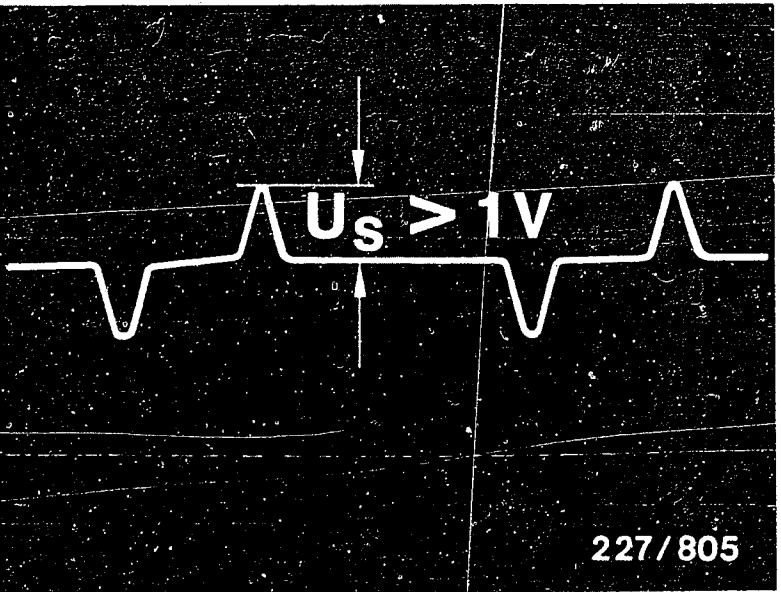
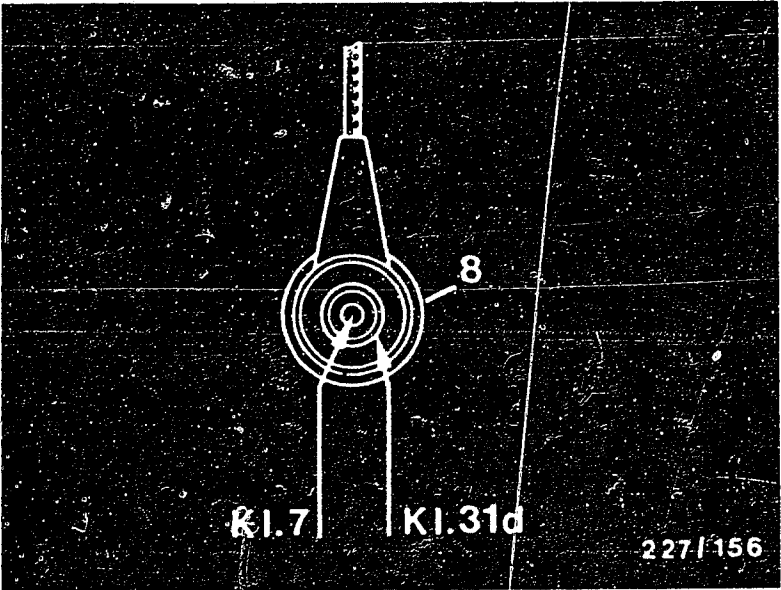
RAPID DIAGNOSIS CHART (continued)
Primary signal/ignition spark present

Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
6	SPARK-ADVANCE ANGLE Detach vacuum hose, EI control unit. Detach plug connection of throttle-valve switch. See top picture, item 1. Engine at operating temp, however < 95° C. Run engine at 3200 min ⁻¹ .	—	USA, JAPAN 25...29° BTDC AUSTRALIA 19...23° BTDC
7	IDLE THROTTLE-VALVE SWITCH Detach KE Jetronic control-unit plug. Attach plug connection of throttle-valve switch. See top picture, item 1. Resistance, EI control-unit plug and battery terminal. See center picture. Throttle valve — idle position Throttle valve — part-load position	2 B-	App. 0 Ω (continuity) Infinity Ω (open-circuit)
8	VOLTAGE, EI CONTROL UNIT AND IGNITION COIL Voltage, diagnosis socket and battery terminal. See bottom picture. Engine idling.	5 B- (+) (-)	12 - 14 V max. 1 V below U _B
9	PEAK-COIL-CURRENT CUTOFF Voltage, diagnosis socket. See bottom picture. Ignition ON.	5 4 (+) (-)	After app. 1 s 0V
10	PRIMARY VOLTAGE Oscilloscope with pulse-shaping circuit at ignition coil. Engine idling.	15 1 (+) (-)	280...360 V



RAPID DIAGNOSIS CHART (continued)
No primary signal/ignition spark present

Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
1	INSULATION, PULSE GENERATOR Resistance, EI control-unit plug and battery -. See top picture	7 B-	infinity Ω
2	INTERNAL RESISTANCE, PULSE GENERATOR Resistance, EI control-unit plug. See top picture.	7 31d	680...1200 Ω
3	VOLTAGE, PULSE GENERATOR Voltage (oscilloscope - "Special") EI control-unit plug. See top picture. Start engine.	7 31d (+) (-)	$U_s > 1\text{ V}$ (Center picture)
4	VOLTAGE, EI CONTROL UNIT Voltage, EI control-unit plug. See bottom picture. Ignition ON.	15 31 (+) (-)	Battery voltage
5	VOLTAGE, PRIMARY CIRCUIT Voltage, EI control-unit plug. See bottom picture. Ignition ON.	16 31 (+) (-)	Battery voltage
6	IGNITION COIL Primary resistance Secondary resistance	1 15 1 4	0,3... 0,6 Ω 7,3...13,2 k Ω



TEST SPECIFICATIONS

Ignition coil, primary	0,3... 0,6 Ω
Ignition coil, secondary	7,3...13,2 k Ω
Contact resistance Supply lines EI control unit/ primary circuit	max. 0,3 Ω
Coolant temperature sensor	+ 20° C 2,1...2,9 k Ω + 30° C 1,4...2,0 k Ω + 80° C 280...370 Ω + 90° C 210...280 Ω + 100° C 160...215 Ω
Spark-advance angle without vacuum Engine at operating temperature, however < 95° C USA, JAPAN AUSTRALIA	25...29° BTDC 19...23° BTDC

TEST SPECIFICATIONS (continued)

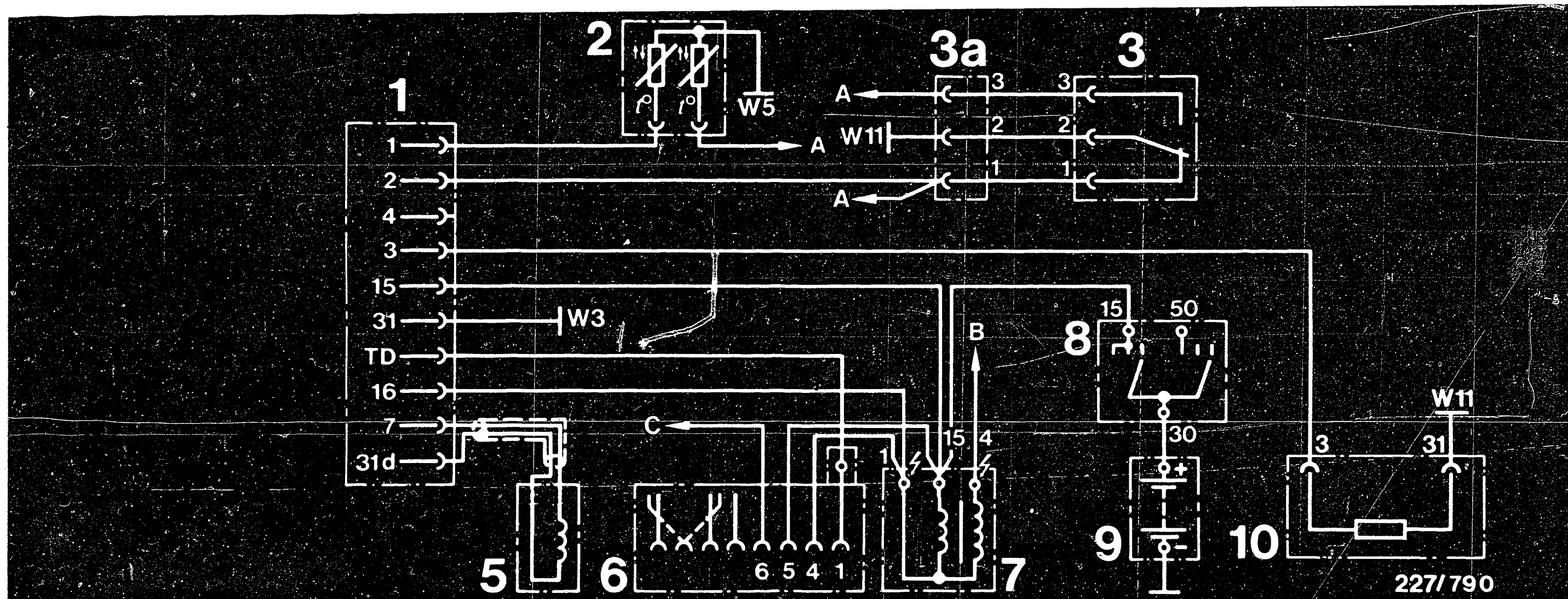
Individual trimming plug	
USA, JAPAN AUSTRALIA	750 Ω 220 Ω
Voltage supply EI control unit and ignition coil with engine idling	12...14 V max. 1 V below U _B
Throttle-valve switch - idle contact	
Idle position Part-load position	app. 0 Ω (continuity) infinity Ω
Peak-coil-current cutoff after app. 1 s with ignition ON	0 V
Primary voltage with engine idling	280...360 V

TEST SPECIFICATIONS (continued)

Insulation, pulse generator	infinity Ω
Internal resistance Pulse generator	680...1200 Ω
Voltage, pulse generator at cranking speed	$U_s > 1 \text{ V}$
Voltage supply EI control unit with ignition ON	U_B
Voltage supply Primary circuit with ignition ON	U_B

For production reasons:
continued on the following
coordinate.

Please refer to SIS microcard, KE-Jetronic
and/or Autodata test specifications for settings
as regards idling speed, exhaust emissions etc.

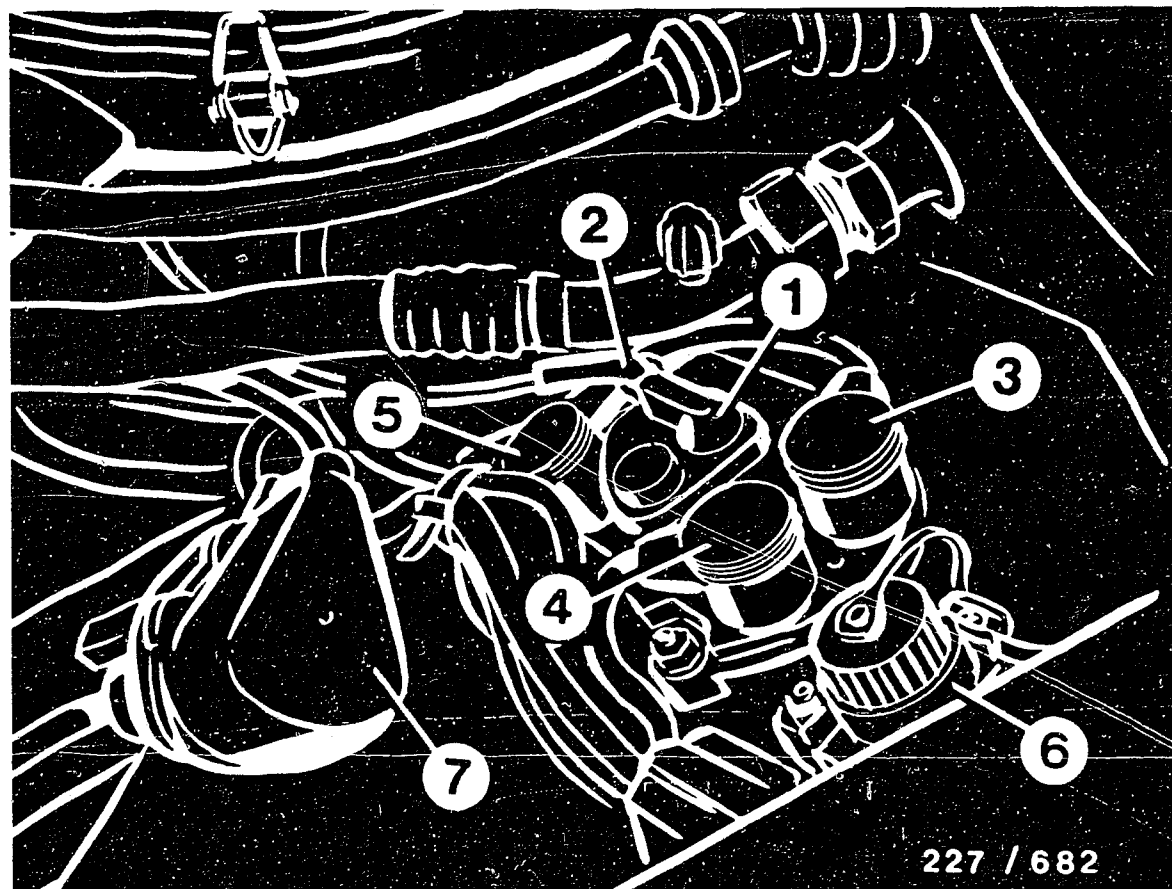


High-tension arrows: Caution, 400 V...25 kV

- 1 = EI control unit
- 2 = Coolant temperature sensor (Twin NTC)
- 3 = Throttle-valve switch
- 3a = Plug connection Throttle-valve switch
- 5 = Pulse generator
- 6 = Diagnosis socket
- 7 = Ignition coil
- 8 = Ignition and starting switch

- 9 = Battery
- 10 = Individual trimming plug
- A = to KE-Jetronic control unit
- B = to high-tension distributor
- C = to central-electrics console (term. 30)
- W3 = Ground, wheel house, front left (ignition coil)
- W5 = Ground, engine
- W11 = Ground, engine (lead screwed on)

ELECTRICAL TERMINAL DIAGRAM



- 1 = EI control unit
- 2 = Vacuum hose
- 3 = Quadruple plug - supply
- 4 = Quadruple plug - sensor
- 5 = Coaxial plug - pulse generator
- 6 = Diagnosis socket
- 7 = Ignition coil with protective cover

INSTALLATION POSITION OF COMPONENTS

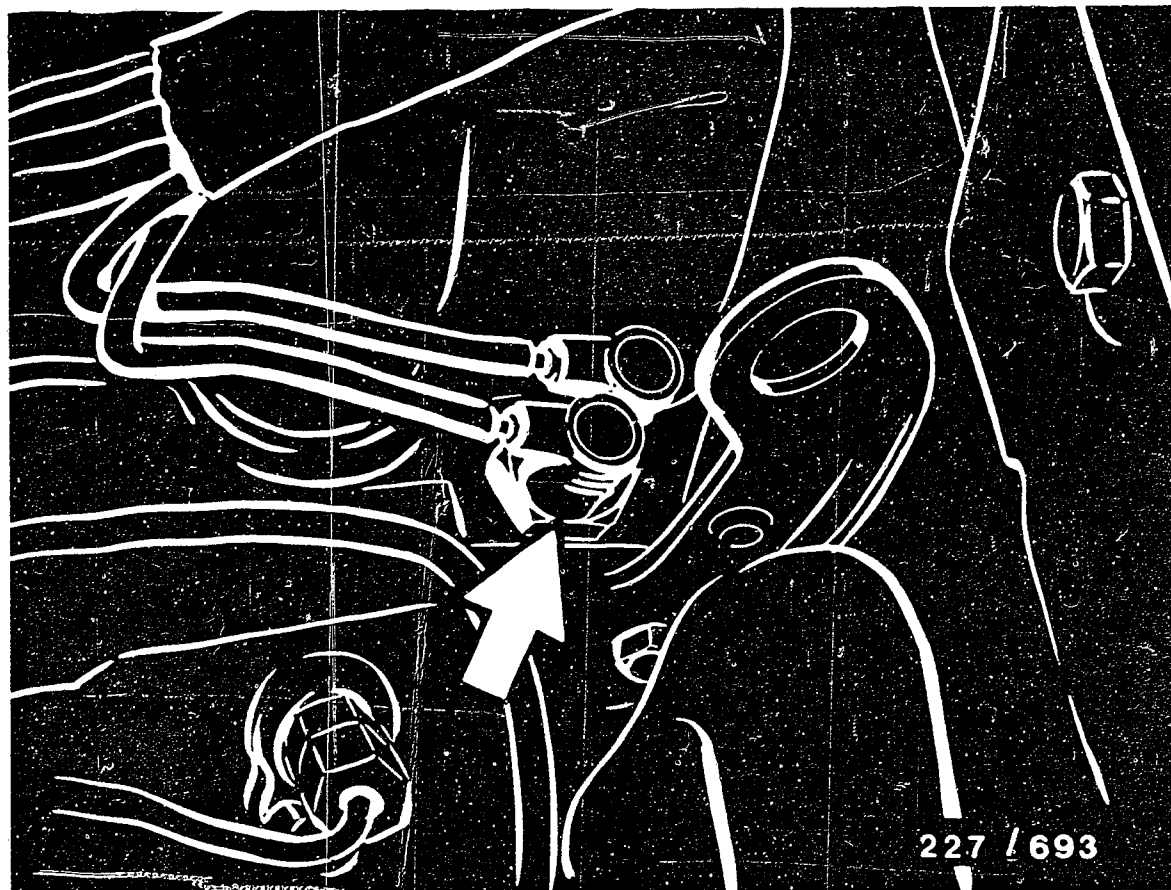
The EI control unit, diagnosis socket and ignition coil are located on the left on the wheel house in the direction of travel.



Arrow = Pulse generator

INSTALLATION POSITION OF COMPONENTS (continued)

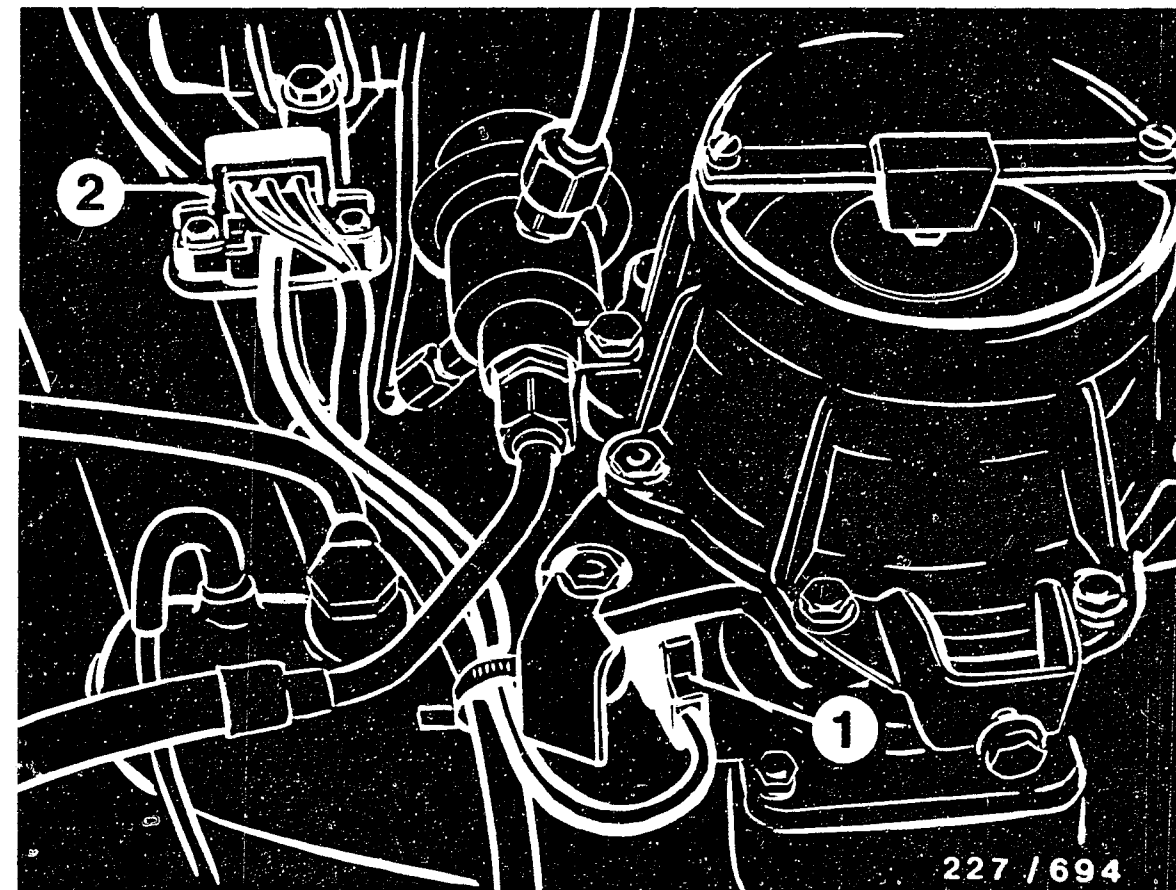
The pulse generator is located on the left on the engine block in the direction of travel.



Arrow = Coolant temperature sensor
(twin NTC)

INSTALLATION POSITION OF COMPONENTS (continued)

The coolant temperature sensor is located
on the side of the cylinder head.



1 = Throttle-valve switch
2 = Plug connection of throttle-valve switch

INSTALLATION POSITION OF COMPONENTS (continued)

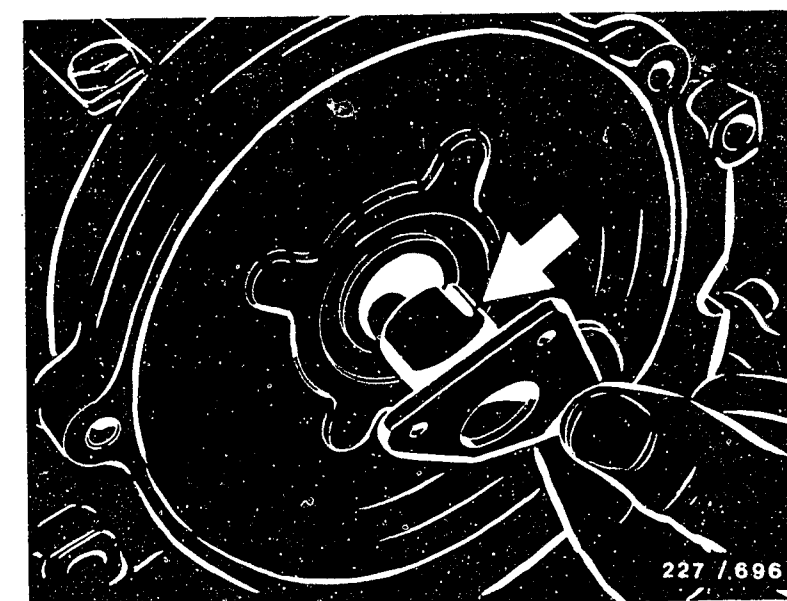
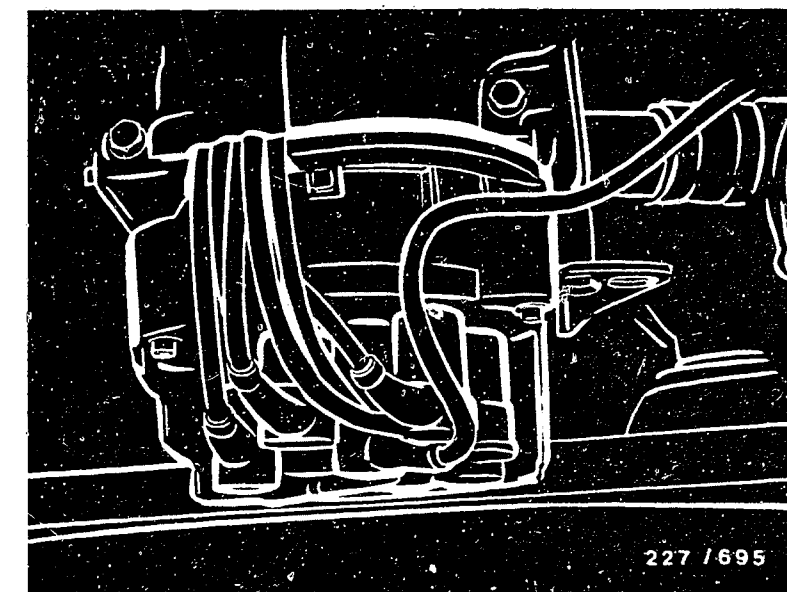
The throttle-valve switch is located on the
throttle-valve assembly.

INSTALLATION POSITION OF COMPONENTS (continued)

The high-tension distributor (see top picture) is attached to the front cover of the cylinder head and driven directly by the camshaft via the driver (see bottom picture, arrow).

The ignition cables at the distributor cap are to be fitted in the sequence 1, 3, 6, 2, 4, 5 (proper laying of ignition cables).

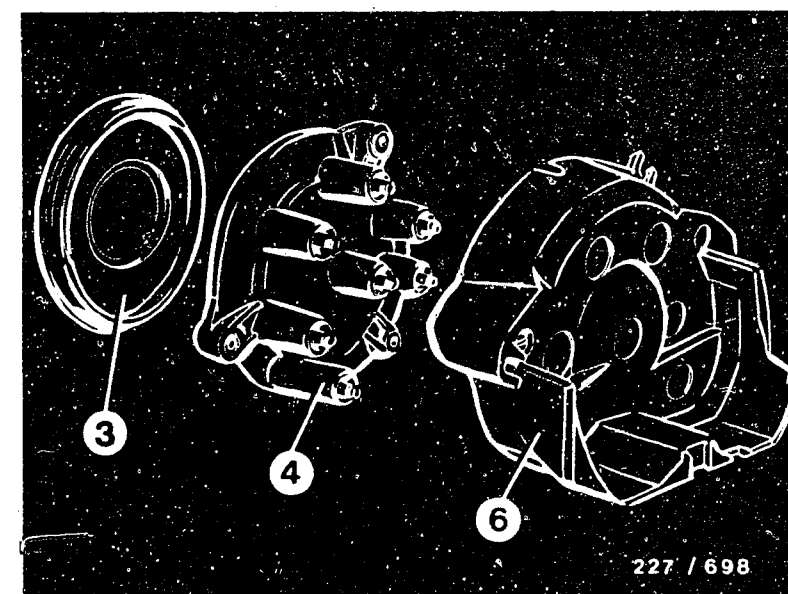
Please refer to next picture page for removal instructions.



INSTALLATION POSITIONS OF COMPONENTS (continued)

Removal instructions for high-tension distributor

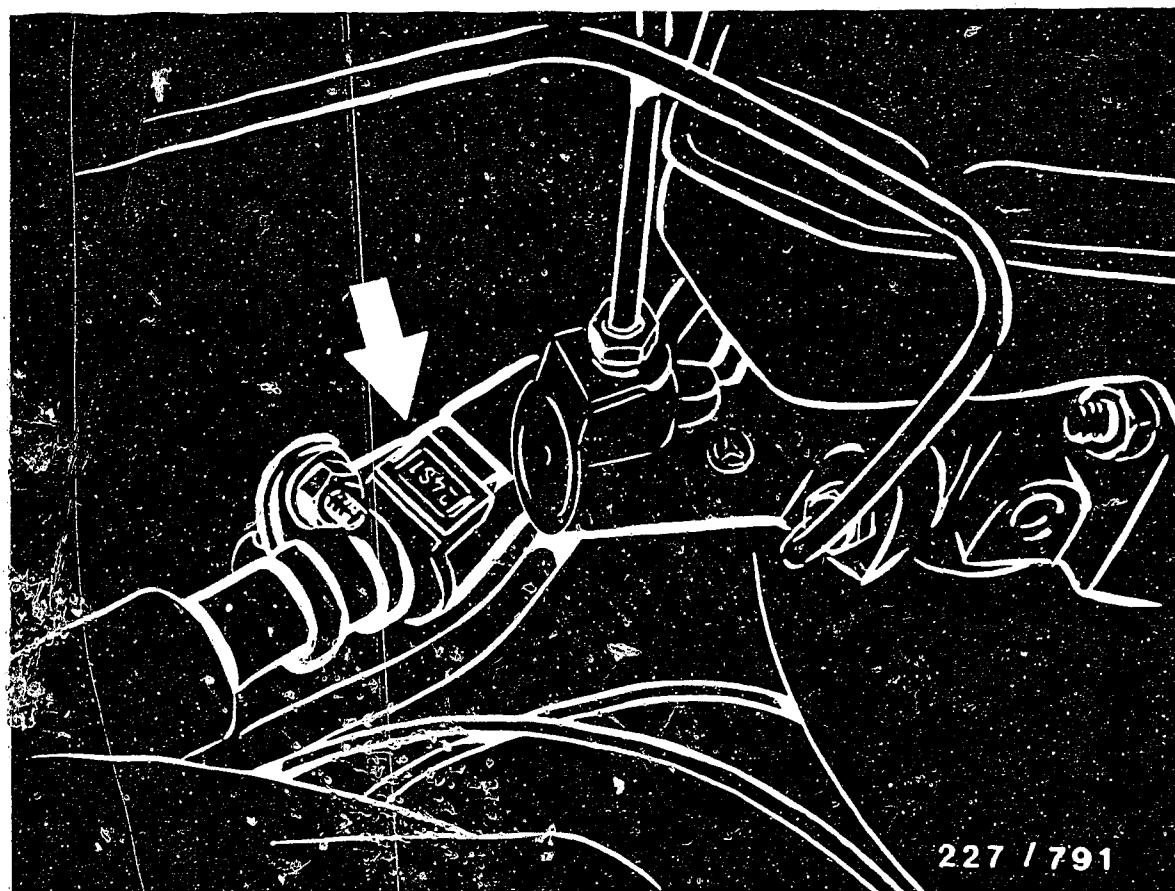
Unclip cover on side (see top picture, arrows) and pull upwards.



Key to picture

- Item 1 = Fastening screws
- Item 2 = Distributor rotor
- Item 3 = Sealing disk
- Item 4 = Distributor cap
- Item 5 = Driver
- Item 6 = Screening cover





Arrow = Individual trimming plug - ignition

INSTALLATION POSITION OF COMPONENTS
(continued)

For production reasons:
continued on the following
coordinate.

Brief instructions : MB-5037
BOSCH system : Electronic ignition (EI)
Make of vehicle : MERCEDES-BENZ
Basic microcard : PKW-059

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SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Mercedes-Benz Model:

190 E 2.6, with 2.6 l/ 6 cyl.
engine 103.942 09.86 ->
USA, Japan, Australia.

- * EI control unit 0 227 400 583 -> 07.87
- * EI control unit 0 227 400 656 08.87->
(with current limitation)
- * Ignition coil 0 221 5..

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

How to use rapid diagnosis chart

Use is to be made of rapid diagnosis chart as of coordinate 07 , if primary signal/ignition spark is present.

Use is to be made of rapid diagnosis chart as of coordinate 11 , if there is no primary signal/ignition spark.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (Engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (Ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on.
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

								Cause (Component fault)
*			*					High-tension side
*								Firing sequence
*			*					Ignition coil
*								Contact resistance
				*	*		*	Pressure sensor
				*	*			Temperature sensor - coolant
				*	*		*	Spark-advance angle
				*	*		*	Throttle-valve switch - idle
			*					Voltage: EI control unit, ignition coil (engine idling)

TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

- Starting motor operates, engine fails to start or starts only with difficulty.
- Engine starts but then dies.
- Idle problems (Engine speed, exhaust gas).
- Poor throttle take-up, flat spot during acceleration.
- Engine missing (Ignition, injection).
- Maximum engine power/ top speed not reached.
- Fuel consumption too high.
- Engine running on.
- Engine pinging/knocking.
- Engine overheating.
- Fault lamp.

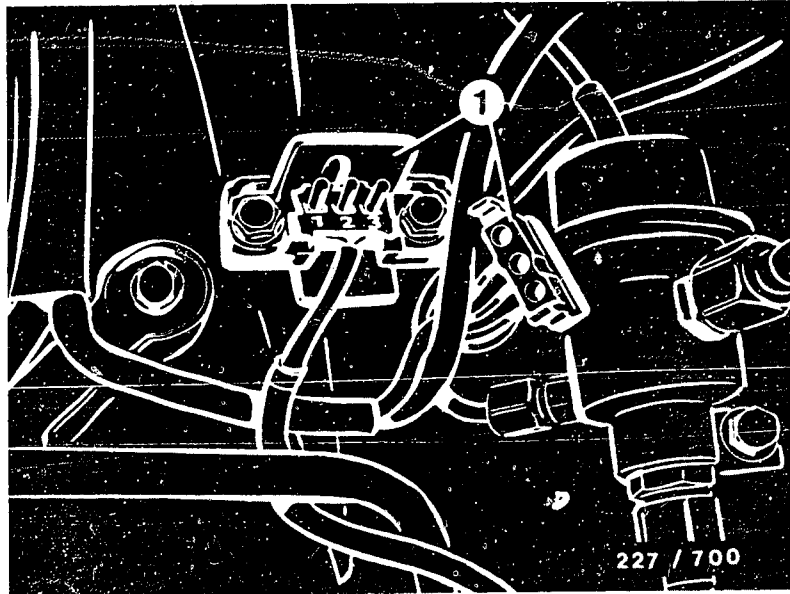
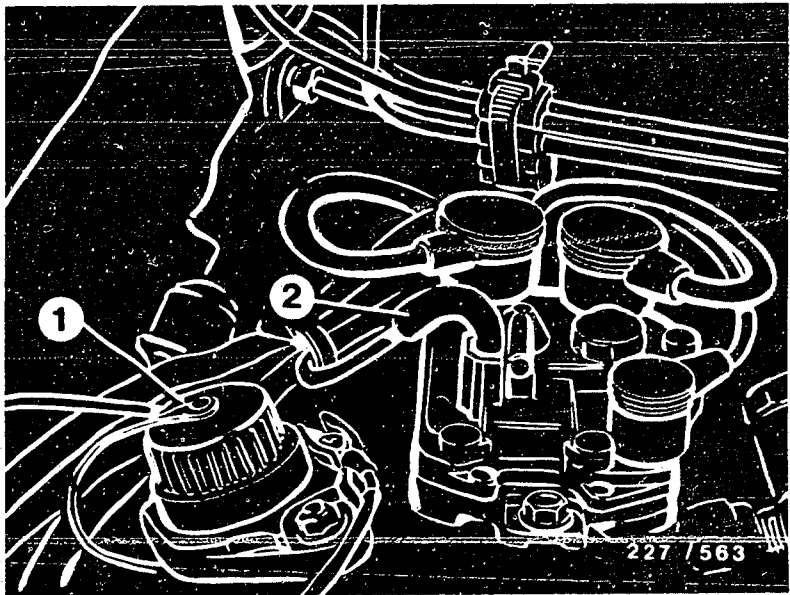
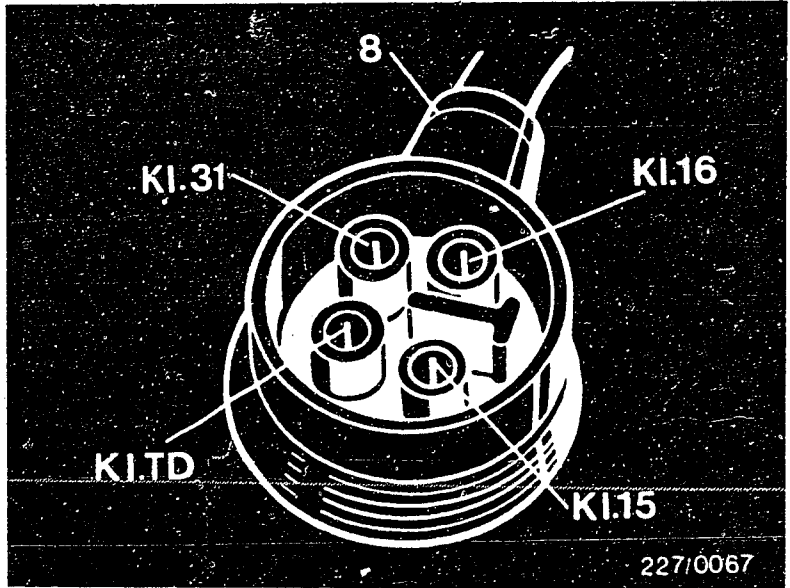
										Cause (Component fault)
*										Peak-coil-current cutoff
		*								Primary voltage
*										Insulation, pulse generator
*										Internal resistance, pulse generator
*										Voltage, pulse generator
*										Voltage, EI control unit
*										Voltage, primary circuit

For production reasons:
continued on the following
coordinate.

RAPID DIAGNOSIS CHART
Primary signal/ignition spark present

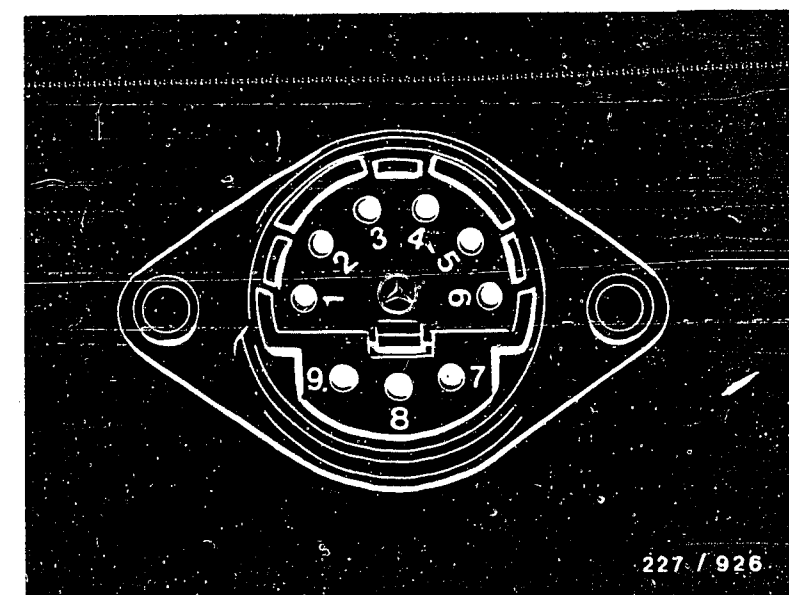
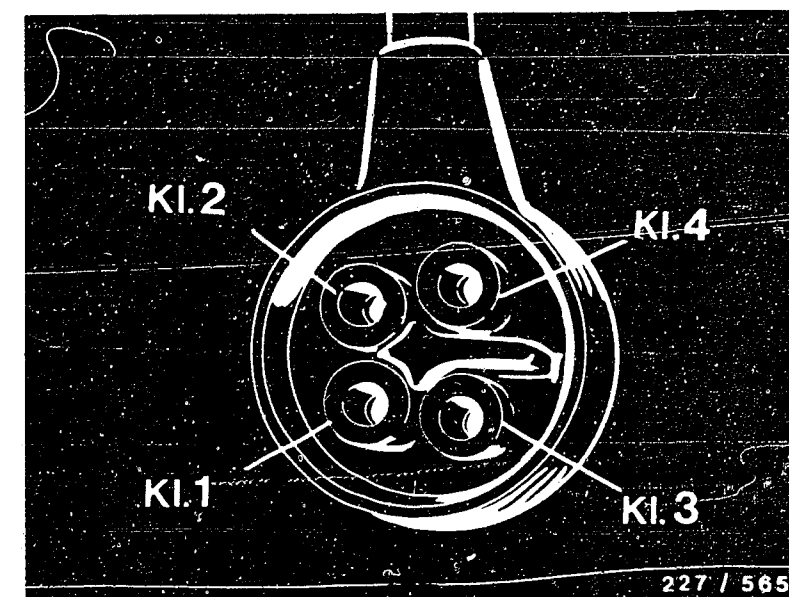
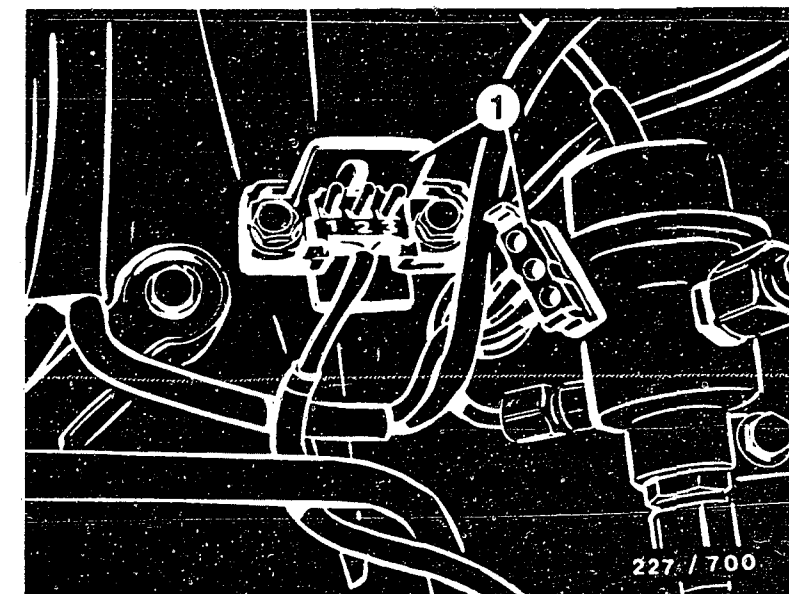
Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
1	HIGH-TENSION SIDE Check functioning (e.g. open-circuit, shunt) of for example spark plugs, ignition harness and distributor cap. Assessment for example by way of ignition oscillogram, resistance measurement, visual inspection.	—	—
2	IGNITION COIL Primary resistance Secondary resistance	1 15 1 4	0,3... 0,6 Ω 7,3...12,2 k Ω
3 *	CONTACT RESISTANCES (primary side) Disconnect - and + leads from battery. Ignition ON. Resistance from battery terminal to EI control-unit plug. See top picture. Resistance from battery terminal to ignition coil. Resistance from EI control-unit plug to ignition coil.	B+ 15 B- 31 B+ 15 16 1	max. 0.3 Ω max. 0.3 Ω
4	PRESSURE SENSOR Detach vacuum hose, EI control unit. See center picture, item 2. Disconnect plug connection of throttle-valve switch. See bottom picture. Engine at idle. Read off spark-advance angle. Attach vacuum hose, EI control unit.	—	ADVANCE spark-advance angle
5	TEMPERATURE SENSOR - COOLANT Engine at operating temperature. Detach vacuum hose, EI control unit. See center picture, Item 2. Detach plug connection of throttle-valve switch. See bottom picture Engine at idle. Read off spark-advance angle. Detach temperature-sensor plug (not illustrated).	—	Change in spark-advance angle

* Perform only with engine not running.



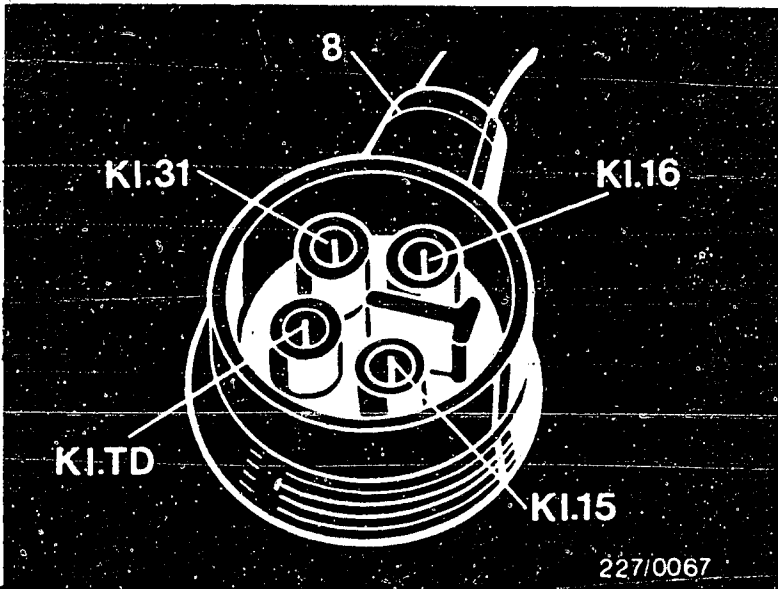
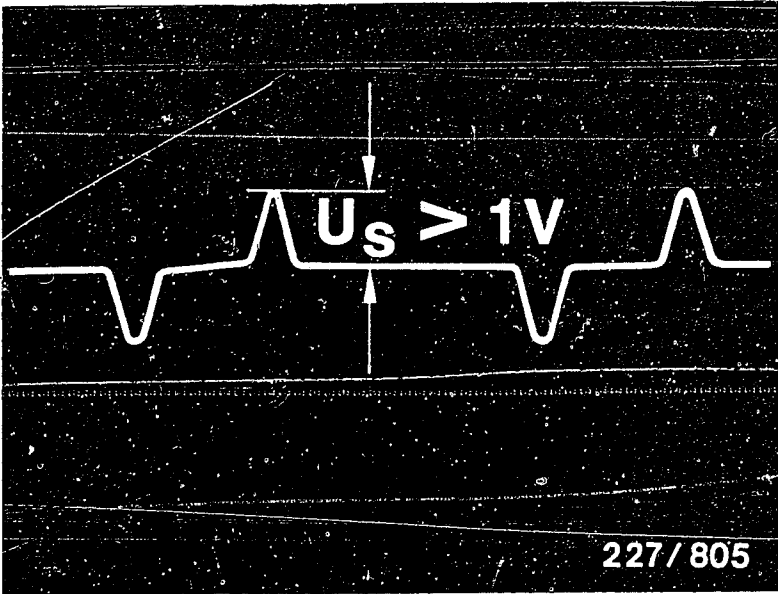
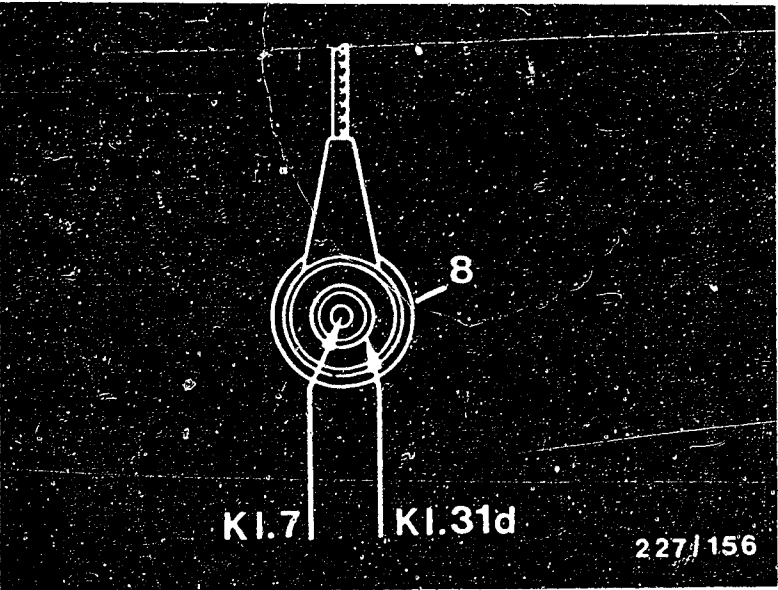
RAPID DIAGNOSIS CHART (continued)
Primary signal/ignition spark present

Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
6	SPARK-ADVANCE ANGLE Detach vacuum hose, EI control unit. Detach plug connection of throttle-valve switch. See top picture, item 1. Engine at operating temp, however < 95° C. Run engine at 3200 min ⁻¹ .	—	USA, JAPAN 25...29° BTDC AUSTRALIA 19...23° BTDC
7	IDLE THROTTLE-VALVE SWITCH Detach KE Jetronic control-unit plug. Attach plug connection of throttle-valve switch. See top picture, item 1. Resistance, EI control-unit plug and battery terminal. See center picture. Throttle valve - idle position Throttle valve - part-load position	2 B-	App. 0 Ω (continuity) Infinity Ω (open-circuit)
8	VOLTAGE, EI CONTROL UNIT AND IGNITION COIL Voltage, diagnosis socket and battery terminal. See bottom picture. Engine idling.	5 B- (+) (-)	12 - 14 V max. 1 V below U _B
9	PEAK-COIL-CURRENT CUTOFF Voltage, diagnosis socket. See bottom picture. Ignition ON.	5 4 (+) (-)	After app. 1 s 0V
10	PRIMARY VOLTAGE Oscilloscope with pulse-shaping circuit at ignition coil. Engine idling.	15 1 (+) (-)	280...360 V



RAPID DIAGNOSIS CHART (continued)
No primary signal/ignition spark present

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
1	INSULATION, PULSE GENERATOR Resistance, EI control-unit plug and battery -. See top picture	7 B-	infinity Ω
2	INTERNAL RESISTANCE, PULSE GENERATOR Resistance, EI control-unit plug. See top picture.	7 31d	680...1200 Ω
3	VOLTAGE, PULSE GENERATOR Voltage (oscilloscope - "Special") EI control-unit plug. See top picture. Start engine.	7 31d (+) (-)	$U_s > 1\text{ V}$ (Center picture)
4	VOLTAGE, EI CONTROL UNIT Voltage, EI control-unit plug. See bottom picture. Ignition ON.	15 31 (+) (-)	Battery voltage
5	VOLTAGE, PRIMARY CIRCUIT Voltage, EI control-unit plug. See bottom picture. Ignition ON.	16 31 (+) (-)	Battery voltage
6	IGNITION COIL Primary resistance Secondary resistance	1 15 1 4	0,3... 0,6 Ω 7,3...13,2 k Ω



TEST SPECIFICATIONS

Ignition coil, primary	0,3... 0,6 Ω
Ignition coil, secondary	7,3...13,2 k Ω
Contact resistance	max. 0,3 Ω
Supply lines	
EI control unit/ primary circuit	
Coolant temperature sensor	
+ 20° C	2,1...2,9 k Ω
+ 30° C	1,4...2,0 k Ω
+ 80° C	280...370 Ω
+ 90° C	210...280 Ω
+ 100° C	160...215 Ω
Spark-advance angle without vacuum	
Engine at operating temperature, however	
< 95° C	
USA, JAPAN	25...29° BTDC
AUSTRALIA	19...23° BTDC

TEST SPECIFICATIONS (continued)

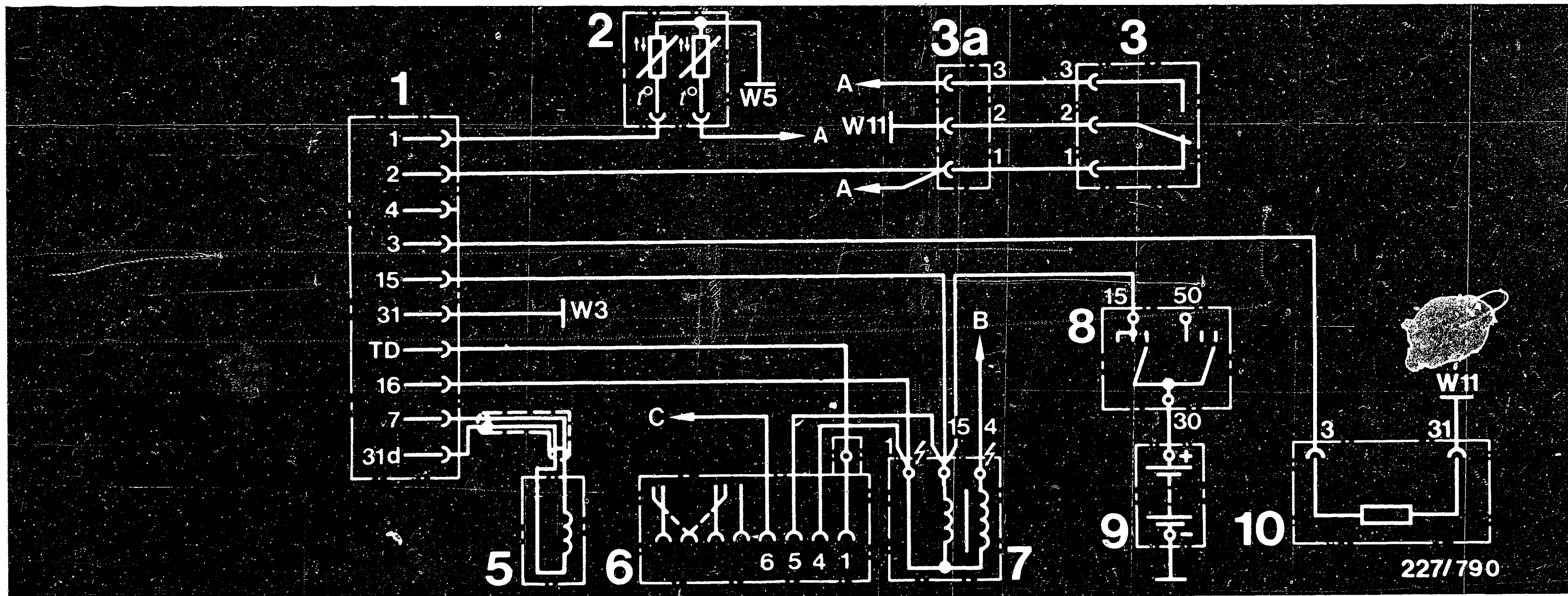
Individual trimming plug	
USA, JAPAN	750 Ω
AUSTRALIA	220 Ω
<hr/>	
Voltage supply	12...14 V
EI control unit and	max. 1 V
ignition coil with	below U _B
engine idling	
<hr/>	
Throttle-valve switch -	
idle contact	
Idle position	app. 0 Ω (continuity)
Part-load position	infinity Ω
<hr/>	
Peak-coil-current cutoff	
after app. 1 s	
with ignition ON	0 V
<hr/>	
Primary voltage	
with engine idling	280...360 V

TEST SPECIFICATIONS (continued)

Insulation, pulse generator	infinity Ω
Internal resistance Pulse generator	680...1200 Ω
Voltage, pulse generator at cranking speed	$U_s > 1\text{ V}$
Voltage supply EI control unit with ignition ON	U_B
Voltage supply Primary circuit with ignition ON	U_B

For production reasons:
continued on the following
coordinate.

Please refer to SIS microcard, KE-Jetronic
and/or Autodata test specifications for settings
as regards idling speed, exhaust emissions etc.

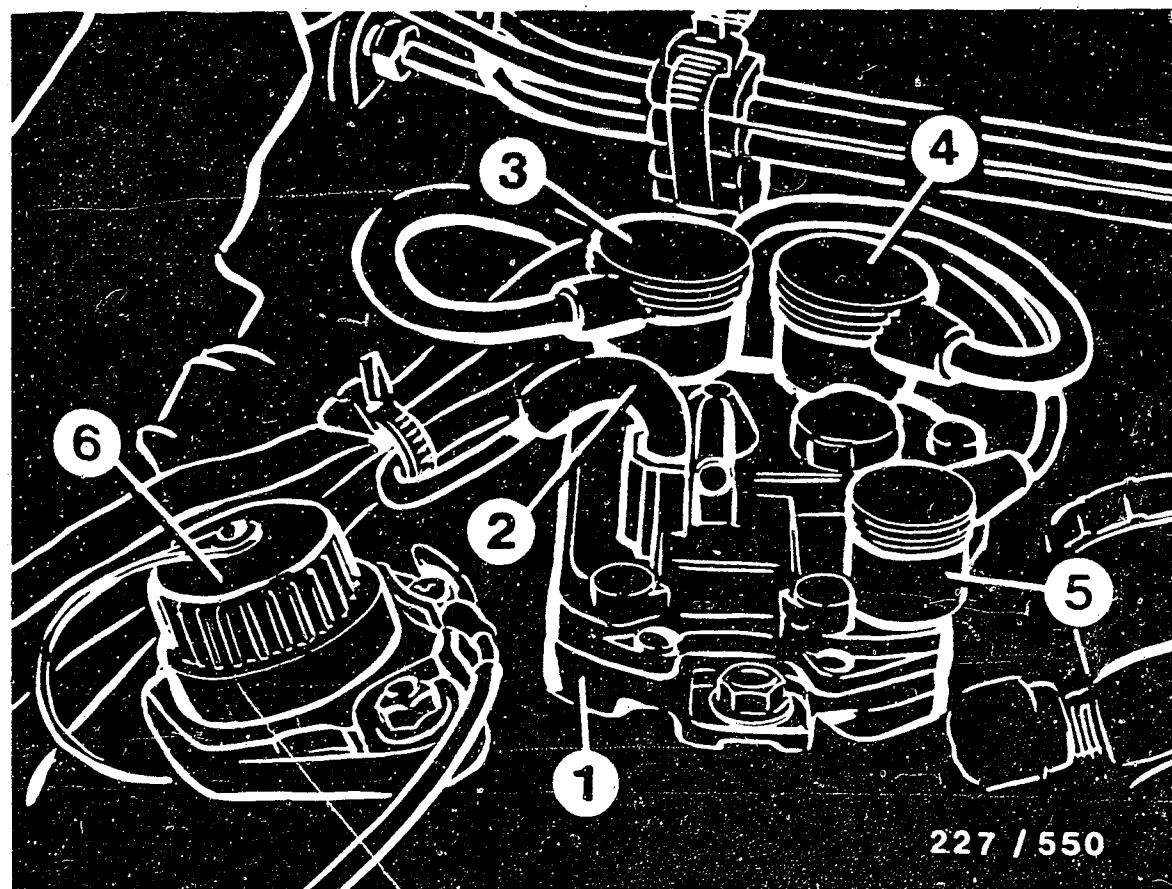


High-tension arrows: Caution, 400 V...25 kV

- 1 = EI control unit
- 2 = Coolant temperature sensor (Twin NTC)
- 3 = Throttle-valve switch
- 3a = Plug connection Throttle-valve switch
- 5 = Pulse generator
- 6 = Diagnosis socket
- 7 = Ignition coil
- 8 = Ignition and starting switch

- 9 = Battery
- 10 = Individual trimming plug
- A = to KE-Jetronic control unit
- B = to high-tension distributor
- C = to central-electrics console (term. 30)
- W3 = Ground, wheel house, front left (ignition coil)
- W5 = Ground, engine
- W11 = Ground, engine (lead screwed on)

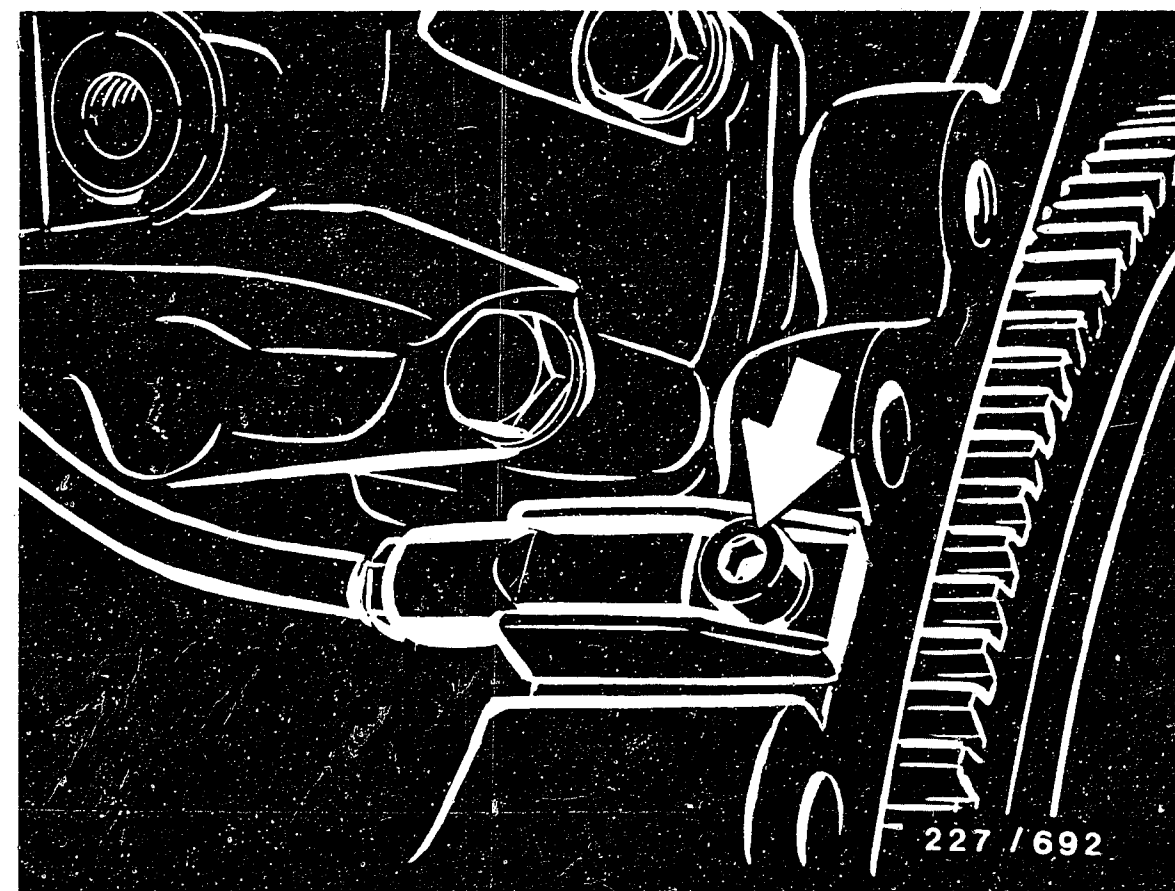
ELECTRICAL TERMINAL DIAGRAM



- 1 = EI control unit
- 2 = Vacuum hose
- 3 = Quadruple plug - supply
- 4 = Quadruple plug - sensor
- 5 = Coaxial plug - pulse generator
- 6 = Diagnosis socket

INSTALLATION POSITION OF COMPONENTS

The EI control unit and diagnosis socket are located on the left on the wheel house in the direction of travel.



Arrow = Pulse generator

INSTALLATION POSITION OF COMPONENTS (continued)

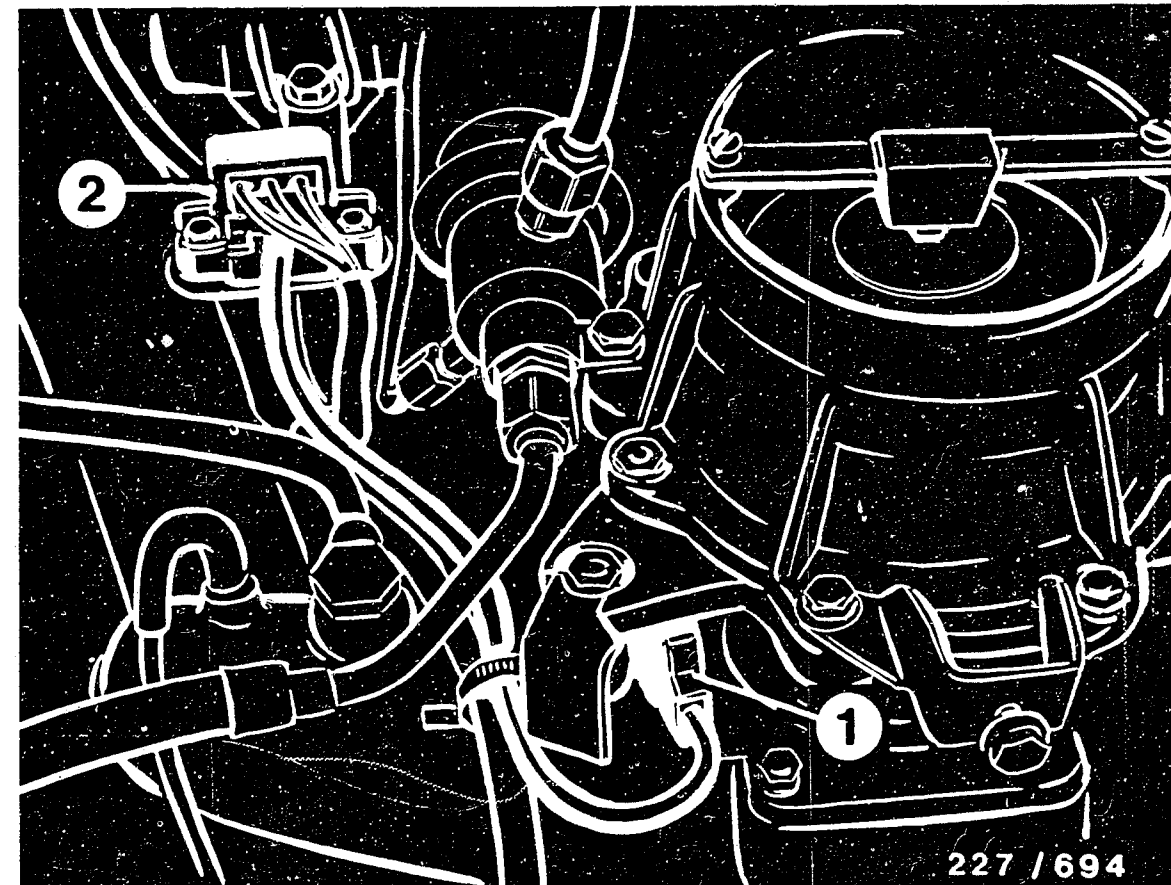
The pulse generator is located on the left on the engine block in the direction of travel.



Arrow = Coolant temperature sensor
(twin NTC)

INSTALLATION POSITION OF COMPONENTS (continued)

The coolant temperature sensor is located
on the side of the cylinder head.



1 = Throttle-valve switch
2 = Plug connection of throttle-valve switch

INSTALLATION POSITION OF COMPONENTS (continued)

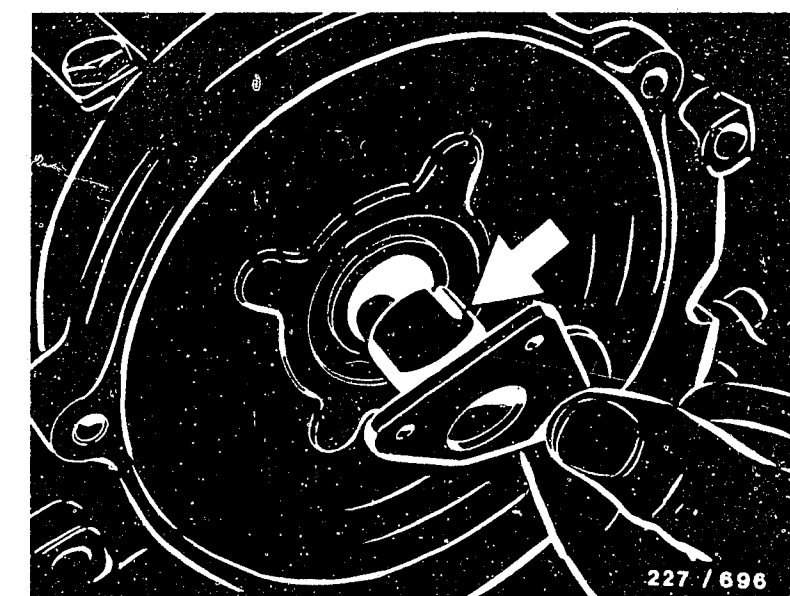
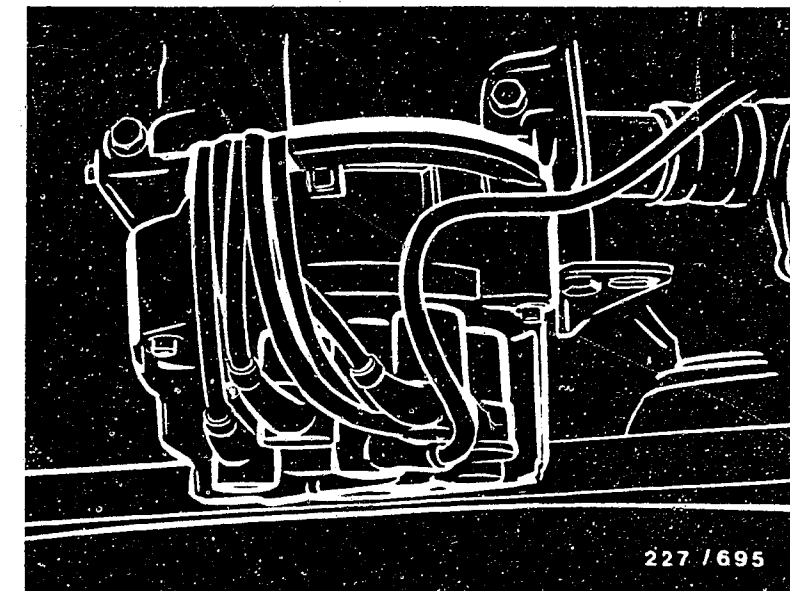
The throttle-valve switch is located on the
throttle-valve assembly.

INSTALLATION POSITION OF COMPONENTS (continued)

The high-tension distributor (see top picture) is attached to the front cover of the cylinder head and driven directly by the camshaft via the driver (see bottom picture, arrow).

The ignition cables at the distributor cap are to be fitted in the sequence 1, 3, 6, 2, 4, 5 (proper laying of ignition cables).

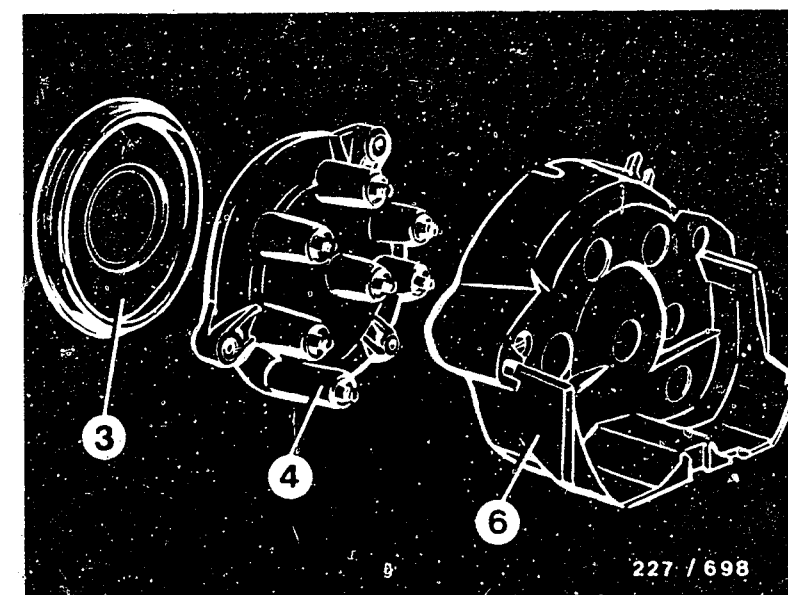
Please refer to next picture page for removal instructions.



INSTALLATION POSITIONS OF COMPONENTS (continued)

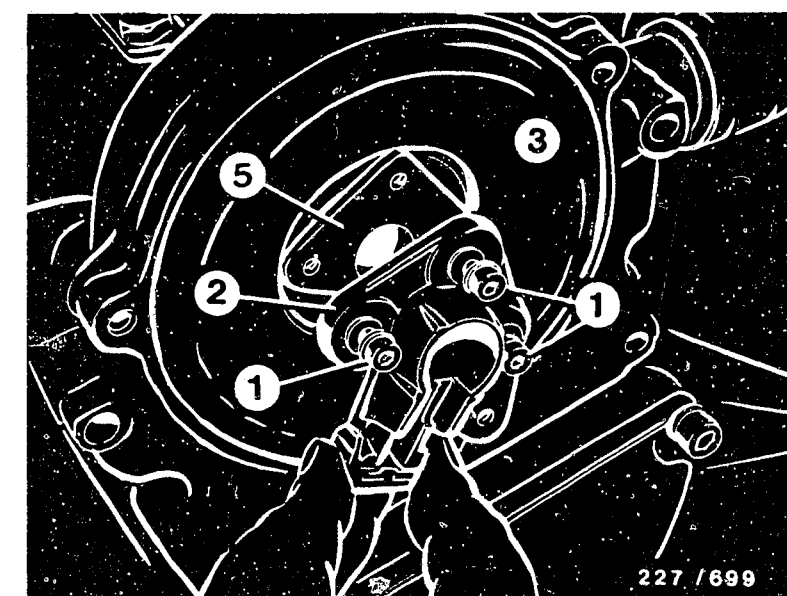
Removal instructions for high-tension distributor

Unclip cover on side (see top picture, arrows) and pull upwards.



Key to picture

- Item 1 = Fastening screws
- Item 2 = Distributor rotor
- Item 3 = Sealing disk
- Item 4 = Distributor cap
- Item 5 = Driver
- Item 6 = Screening cover





Arrow = Individual trimming plug - ignition

INSTALLATION POSITION OF COMPONENTS
(continued)

For production reasons:
continued on the following
coordinate.